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NEWTON'S
London Journal of Arts and Sciences.

No. XCI. (NEW SERIES), July 1st, 1862.

The International Exhibition.

DECORATIVE ART.—ARTICLE II.

Wrought Metal Work.

In no branch of manufacture is progress more evident than in wrought metal work. But lately it was an art revived in England solely with the view of providing suitable fittings for the Palace of Westminster, and already it has become an extensive trade. A small collection of works in the Mediæval Court of the 1851 Exhibition, sufficed to show that an eminent architect, backed by the national purse, had succeeded in reviving the art of working in wrought iron and brass; and, in the present Exhibition, this manufacture, which had died out with the extinction of true architectural feeling, takes a prominent place.

The specimen in this class which, both from its imposing size and beauty of design, first arrests attention on entering the building, at the eastern dome, and looking down the south transept, is the wrought iron rood screen of the Skidmore Art Manufactures Company, of Coventry, designed by Mr. G. G. Scott, R.A., and constructed for the choir of Hereford Cathedral. It is composed of five pointed arches; the middle one, which rises higher than the others, being surmounted by a gable, which carries a cross at its apex. The heads of the arches are filled with tracery, and they are divided by a central twisted pillar of brass, the lower part of the side arches being also filled with panels formed of wrought iron foliated scroll work. In an oval division of the tracery of the central arch is a bronze figure of our Saviour, and on either side, supported on corbels, is a group of figures. At the ends of the screen there are also figures similarly supported. The main pillars are in part incased in burnished brass, which metal is so judiciously distributed over the whole structure as to produce a charming effect. The whole of the iron work is painted in low-toned tints of red, green, brown, and purple, obtained from oxides of that metal. Admirable as this specimen of modern metal work is, we must take exception to a portion of its details, lest the practice which is here admitted, and elsewhere resorted to, as we shall presently see, should, by going unchallenged, and having, perhaps, ancient precedent to rely upon, become confirmed, and thereby open the door to meretricious ornamentation. Our objection lies, not against the design, but the manner of working

out the foliated filling of the panels of the side arches, where, in order to give both faces of the screen the same appearance of finish, certain prominent leaves are made in duplicate, and attached to opposite sides of the panel scroll work. The exception we take to this is, that in works such as screens or gates, both sides of which are exposed to view, the leaves or flowers of the design, having their proper natural relation to the stem which carries them, must show their back and front surfaces on opposite sides of the panel. Neglect of this æsthetical rule introduces confusion into the design, and produces a heavy and meretricious effect, even where delicate manipulation is applied to the execution of an elegant design. This is even more apparent in the wrought iron park gates, near the centre of the nave, manufactured by Messrs. Barnard, Bishop, and Barnard, of Norwich, which show a far larger surface of panelling than the rood screen,—one portion being carried out on the false or meretricious principle, and the other on the true principle of wrought work. In the lower panels of the gates, and also in the panels of the hollow piers (which are of cast iron) duplicated foliage is introduced; so that not only do you see the face of the elaborated design, but there is also in view the reflection, as it were, of the back of the leaves—the effect being precisely similar to that which would be obtained by placing a mirror in close contiguity to the back of a properly carried out design.* Again, at the entrance of Messrs. J. Hardman and Co.'s court, is a pair of wrought iron gates, unpainted, and showing exquisite workmanship, in which the duplication of foliage is also carried out; but in this example the objection does not hold with like force, as the duplicated foliage is rivetted to solid backing. Exception may, perhaps, be taken to the quality of this design, which is somewhat stiff, and of an elongated, upright character; but the manner of carrying it out gives evidence of a practised hand, conversant with those rules, a departure from which invariably detracts from the artistic effect of the best work. A pair of rood screen gates, exhibited by Messrs. Benham and Sons, although not happy in design, deserve notice as good hammered work, wrought apparently with careful attention to the rule we desire to enforce.

Perhaps there is no practice which has served so effectually to debase ornamental cast work as the piling together of separate castings to produce ornaments, which are thus made attachable and detachable at pleasure. With stove and fender manufacturers this has been long in

* The South Kensington Museum contains a fine example of a wrought iron screen, attributed to a Nottingham blacksmith of the name of Shaw, containing foliated work, with counterpart leaves on the obverse side. Its date is given as 1695, and, doubtless, instances of the practice at a much earlier period might be adduced; but no amount of evidence of this nature would suffice to remove the objections we have advanced against it.

vogue, the ornamentation having the same relation to the structure it adorns as the trimmings have to a bonnet. We are very sorry to find this vice making its appearance in wrought work, as showy effects are rapidly obtained thereby; which inducement, if not counteracted, may tend to an indulgence in overlaid ornament. At first view, this objection may appear to be a repetition of what we have already discussed, but it is a much further departure from the true principles of wrought work, which admit of no detachable parts,—unity of structure being secured either by welding, which is the best means, or by rivets. In a pair of wrought iron gates, exhibited by Messrs. Hart and Son, who, as we understand, do not take the responsibility of the design, some circular panels are filled with star-shaped ornaments in copper, which ornaments are composed of overlaid or piled (not laminated) pieces of sheet copper, beaten out respectively to their required shapes, and attached together, and held in place, by means of a screw bolt and nut. These fillings are, therefore, simply detachable ornaments, and may, at any time, be replaced by others equally inappropriate, or removed altogether, without in any way affecting the construction of the gates. This example shows, also, duplicated foliage, embracing and binding structural parts of the gates. The workmanship, however, is very satisfactory. The Skidmore Art Manufactures Company show also another imposing work, in the form of a tomb-canopy, which is of elegant design, executed chiefly in iron, and painted in the same peculiar and most successful manner as their rood screen. Altogether, the display of wrought iron is very creditable, and as nothing of the kind, so far as our researches have gone, is to be found in the foreign courts, our manufacturers have the field entirely to themselves. The merit, so far as workmanship is concerned, is tolerably equal—the superiority, perhaps, inclining to Messrs. Hardman; but it is manifest that, besides a thorough comprehension of the rules of the art, it is important that manufacturers, for their credit's sake, should unite themselves with competent designers. This advantage Messrs. Hardman had in starting the manufacture, their workmen being educated under the eye of the late A. W. Pugin, the reviver of mediæval decorative art. A similar advantage is now enjoyed by the Skidmore Company, to whom Mr. Scott entrusts his designs; but of skilful designers, happily, there is no lack, and, therefore, all who can work well may find good scope for their abilities.

If, however, the supply of this class of work is ever to equal the desire for its possession, the cost of production must be materially reduced. This can only be effected by the introduction of modern mechanical appliances, which have done so much towards reducing the price of most articles of manufacture. It is manifest that this class of work involves not merely the exercise of artistic skill in carrying out the designs of

the architect, but also considerable physical force and tedious manipulation in working the malleable iron into form. Whatever, therefore, is calculated to economise this labour, should be diligently sought out and quickly applied. The first point to be considered is, whether, through the numerous inventions for improving the manufacture of iron, some better material is not available than has heretofore been employed; and the second is, whether the power placed in our hands by the steam hammer (which is constantly receiving extended applications), or other equivalent force, cannot be adapted with advantage to this branch of art manufacture. It is generally believed, that the province of stamping dies is to produce with rapidity repetitions of the same forms, and nothing else; and, consequently, it may be inferred that such tools operated by a steam hammer must necessarily debase all artistic work to which they may be applied. So far from this being the case, it is well known that artificial flowers are produced on an exactly similar principle, and without committing ourselves to the commendation of this art, it is enough for our purpose to state that identity or monotony of form in flowers or leaves, howsoever often repeated, is not the vice of the artificial flower manufacture. Dies, therefore, if the draughtsman's art be put into them, will produce artistic basic forms of leaves ready for modelling by the hammer into such graceful curves as may fit them for their destination in the design. During this manipulation, though the typical form will be preserved, an individuality must of necessity be given to each leaf that will distinguish it from all others, and thus a dull uniformity of grace will effectually be avoided.

We commend this suggestion to the serious consideration of the artistic workers in wrought iron, and, at the same time, would direct them to the specimens of malleable metal exhibited by Messrs. Naylor, Vickers, and Co., and by the Manager of the Royal Arsenal at Woolwich, which show the capabilities, both as respects metals and the means for working them, that modern invention has laid at their feet. If, further, they require stimulating to renewed efforts, we would direct their attention to a chair now exhibiting at the Kensington Museum, which, as a work of art in steel, has rarely, if ever, been equalled. It will be recognized as ornamented in bas-relief, the subject being Nebuchadnezzar's dream. This chair was presented by the City of Augsburg to the Emperor Rudolphus II.: it bears the date of 1577, and was wrought by Thomas Ruken.

The Exhibition is also rich in examples of wrought brass, mainly for ecclesiastical use; the chief articles being lecterns, gas standards, and coronas. These works so plainly assert their superiority, both in design and workmanship, to the kindred works in ormolu—which they are

destined entirely to supersede in this country—that they might well pass without criticism; but it is important to the permanent success of any new branch of manufacture, that it should be properly launched, and for this reason we would desire to refer to some points in the brass work of the Exhibition to which exception may be taken.

In the first place, this branch of art manufacture is too evidently treated as a revival, with the assumption that what has been may be, and should ever be, admired. This is the fault which, as already pointed out, our potters have fallen into,—contenting themselves with imitating the vagaries of the early masters of their art, instead of combining a purer taste with their newly acquired manipulative skill. Thus, Messrs. Hardman exhibit, among a collection of beautiful works, deserving of unqualified praise, a costly lectern, which sets at nought one of the first principles of decorative art, viz., that designs must be specially adapted to the material in which they are to be carried out. This rule necessitates varieties of character in designs, not merely according to their subject, but also according to the material employed in their execution, and ensures that harmony in all parts of a building that cannot otherwise be attained. The lectern to which we refer consists of a central pillar, for supporting the usual eagle which carries the desk. This pillar is made of hollow open work, and castellated. It is supported at foot by three buttresses of open work, which rest on a common base that is carried by lions. The structure is decorated by three figures of angels, supported on corbels. Here is an example, formerly only too common, of introducing architectural features suited only to stone work, into wrought brass; and precedent will, no doubt, carry the day, if reason is not allowed to act unfettered. If another example of a lectern, by the same manufacturers, designed on a different principle, be compared with the architectural design, the inappropriateness of the latter will at once be discovered. It consists simply of a twisted pillar for carrying the eagle, its broad base resting on three feet, composed of lions. Among the large collection in this court, we notice also some small standard gasaliers of admirable design. Messrs. D. Hulett and Co. show also good examples of mediæval gas standards. Messrs. Johnston Brothers show an admirable piece of revived mediæval work in the form of a standard gasalier, designed by Mr. George Trufitt. The design is not without its merits; but, in one respect, it appears to us to fail. The base is an adaptation of the quaint shelving foot of 13th century cups: it is a tapering octagon, showing flat sides, which extend, unduly, far beyond the centre pillar, and are profusely decorated with settings of colored glass, arranged in bands. The upper part is light and elegant, and consists of curved branching tubes, which spring from the standard and support a ring of jets,—the curved tubes being

bound together at different elevations by three bands studded with glass settings. Messrs. Hart and Son exhibit a most extensive assortment of mediæval adaptations, their attention having been directed not merely to church furniture, but also to domestic wants. Their display of gas pendants, lamps, and coronas are highly creditable. A large corona, suspended by knotted cords of bright twisted brass, and carrying a terminal similarly supported, has a singularly elegant effect. But perhaps the example which most claims attention in Messrs. Hart and Son's court, is a pair of gigantic brass candlesticks, designed by Mr. Butterfield. The pattern on the stems of these candlesticks is worked out by flat colors very happily introduced, and they are further ornamented by bosses of crystal, after the manner of jewelling cups. A strong desire appears to possess our mediæval metal workers to outdo their predecessors in gem and crystal setting. It is, however, a question whether this practice is admissible; and for our part we are inclined to advise its total abandonment. In the foreign departments, we find but one example that falls within our subject, and that is in the French department, where M. Barbedienne, among his choice specimens of bronzes, shows an elegant massive gilt mediæval chandelier, containing three tiers of sconces and ornamented with enamelling. With this exception, England appears to be unchallenged in wrought brass, as in iron work. We trust, however, that our manufacturers will not rest on their laurels; but that while studying ancient work, in order to adapt their newly acquired skill to modern wants, they will strive to distinguish between meretricious and legitimate effects, and not neglect the opportunity of combining invention with manipulative skill.

MILITARY ENGINEERING AND APPLIANCES.

The International Exhibition of 1851 was remarkable for the almost entire absence of everything relating to war and warlike appliances. In their report on Class VIII., the jury noticed this deficiency, observing—"It has apparently been felt that since it is the main object of the Exhibition rather to make known the progress and to promote the arts that add to the comforts and enjoyments of life, than the powerful and destructive engines employed in war—such engines are not in place here." Neither Great Britain nor France exhibited anything in the way of ordnance, beyond a few models of field artillery, which contained nothing new or remarkable in construction. The contributions of other countries, exhibited under this class, were rather samples of manufacture and of materials than instruments of war possessing original merits of construction. The specimen most deserving of notice, under the

head of ordnance, in the Exhibition of 1851, was a 6-pounder gun, 5½ feet long, made by Mr. Krupp, of Essen, in Prussia, from a material then called "native cast steel," but now known as "puddled steel." This material has since obtained considerable notoriety, and is successfully applied both to the manufacture of heavy ordnance and also of ships' armour plates.

In the present Exhibition, Class XI. (Military Engineering) and Class XII. (Naval Architecture) occupy a very prominent position, and receive from the visitors an amount of attention which could scarcely have been expected for subjects so purely scientific and professional. In noticing the various articles and contrivances exhibited in Class XI., it will be convenient to consider them under the following heads, viz.:—1. Ordnance, projectiles, and armour plates. 2. Small arms, including rifles, pistols, swords, and bayonets; together with accoutrements, and targets used in rifle practice. 3. Fortification, including field works and the appliances connected therewith; the construction of bridges and roads; tents, camp equipage, field hospitals and ambulances, &c.

Ordnance, Projectiles, and Armour Plates.

Under this head there is a most interesting collection of objects, the War Department of the British Government taking the lead with an instructive display of ordnance in different stages of manufacture. The ordnance trophy, furnished by Mr. Anderson, the talented superintendent of the Royal Gun Factory at Woolwich, displays field and other guns, of various sizes, arranged in such a manner as to explain the mysteries of manufacturing the Armstrong rifled ordnance,—the coiling of bars of wrought iron round a mandril, and the welding of the coils together, being clearly illustrated. Finished Armstrong guns of large bore, ready for immediate service, are also shown. Near this trophy is a collection of sectional models, showing the construction of a large variety of shells and hollow projectiles, with the fuzes appertaining thereto, being the invention of Sir William Armstrong. Many of these models are made full size, and the whole collection is well worthy a minute inspection; but it would be impossible in words to give an accurate idea of their peculiarities of construction. While some are designed to explode on striking an object, the explosion of others is timed by the burning of a fuze. There are shells also made to contain parachutes, which are provided with illuminating compounds; the explosion of the projectile, at a certain elevation, releasing the parachute and igniting the compound, which thus illuminates the darkness and facilitates the operations of reconnoitring parties.

The largest Armstrong gun made on the coiled system, although a powerful and, no doubt, an effective weapon, for some purposes, is completely eclipsed by the "Prince Alfred," a gigantic piece of ordnance, made and exhibited by the Mersey Iron Works Company, Liverpool. This formidable weapon was forged hollow, and has a bore of 10 inches. Since it was rifled, it has carried an elongated ball of between 400 and 500 lbs. weight. It was tried on the North Shore, at Liverpool, as a smooth-bore gun, with a spherical shot of 136 lbs. weight, and with charges of from 20 to 30 lbs. of powder, against a target made of 4½-inch armour plates, backed with 18 inches of teak and a solid bank of sand. The fragments of this plate are placed alongside the gun, and show the result of the firing. Another plate, exhibited by the same firm, was smashed on the 23rd May, 1856, and was the first armour plate ever broken by a spherical shot; the shot weighed 282 lbs., and was propelled, by a charge of 28 lbs. of powder, from the 13-inch Horsfall gun, which is now in the possession of the Government. This gun was for a long time allowed to lie and rust on the beach at Shoeburyness, but it has recently, owing to the energetic representations of the manufacturers, been removed, for the purpose of having some trifling defects remedied, previous to being taken into regular service.

Captain Blakely exhibits a 200-pounder pivot gun, the peculiarity of which appears to be in the mode of rifling. In this gun there are no grooves, properly so called; the rifling consisting in cutting the bore into a number of lands, which are made in curves, partially concentric to the bore, and partially cycloidal; consequently, at their inner ends, these curves form shoulders or internal ratchet teeth, against which corresponding projecting teeth, on the side of the projectile, bear when discharged from the gun. Several guns of this construction have been made for foreign governments, but none, so far as we can learn, have been adopted in the British service.

Mr. Lancaster exhibits a wrought iron gun, constructed on his principle of a twisted oval bore—it weighs 95 cwts., and carries an 85 lb. shell, with a charge of 12 lbs. of powder. The twist in the length of the gun is equal to one quarter of a revolution. It is stated to have fired 604 rounds, and is still perfect in all respects. Mr. Lancaster also exhibits what he terms "armour planking for ships." This planking requires no bolt holes, but is rolled with rebated edges; the plates are rolled edgewise, and therefore there is no risk of lamination. The inventor claims for this invention great economy in the construction of armour-plated vessels, as he asserts that his plates can be made and applied at £20 per ton less than those of the "Warrior," thereby effecting a saving of

some £34,000 on that class of vessel. Plans for securing armour plates without bolts have been proposed by other inventors, but until submitted to the test of heavy firing, their value cannot be confidently estimated. The Mersey Iron and Steel Works Company also exhibit in the western annexe a Titanic armour plate, made of puddled steel, weighing 13 cwt. 1 qr. 25 lbs., and measuring 23 feet 3 inches long, by 6 feet 3 inches wide, and 5½ inches thick. No price per ton is quoted for this gigantic specimen of forging, but the manufacturers assert that they can, without difficulty, make plates 40 feet long, if desired, at no very material increase upon the price per ton they should charge for that exhibited.

Various foreign contributors exhibit guns of different kinds, but, with the exception of those of Mr. Krupp, of Essen, none of the articles are remarkable either for size, excellence of manufacture, or peculiarity of construction. Mr. Krupp, in the western annexe, exhibits several guns, of varying calibres, up to 9 inches. They are all apparently intended for breech loaders, but none are provided with the necessary appliances. We presume, therefore, that they are exhibited simply as specimens of forging.

Small Arms, Accoutrements, and Targets.

The number of small arms, including breech-loading rifles, revolvers, self-capping contrivances, &c., is legion. It would be utterly impossible to give a lucid explanation of the numerous ingenious contrivances included in this sub-class, without far exceeding our prescribed limits. An extended examination of the breech loaders has not assured us that the difficulties incidental to this class of weapon are completely overcome. The requirements in a breech loader are:—1. Extreme simplicity and strength of parts, so that, without danger, it may be placed in the hands of the common soldier. 2. Such an arrangement of parts as will necessitate the fewest possible number of motions, and offer no risk of accidental discharge. 3. Freedom of working; an almost insuperable difficulty having arisen from the expansion, by heat, and the consequent binding of the working parts, caused by continuous firing. All these difficulties must be overcome, before a really effective weapon can be produced.

Of late years, considerable attention has been devoted to the personal comfort of the soldier, and various plans have been devised for enabling him to carry his accoutrements and knapsack with the least possible inconvenience. The Exhibition presents several contrivances for effecting this desirable object. The most noteworthy plan of carrying the knapsack and accoutrements is that proposed by Col. Carter, who, by re-arranging the belts, and dispensing with those which are calculated

to interfere with the action of the arms and the chest, enables the soldier to vary the position of his load, to such an extent that different sets of muscles may be brought into play; thus giving rest to those muscles which have been kept for some time on the stretch. Col. Carter also exhibits a boot, with a divided sole, whereby great ease is given in walking, and yet the required rigidity for supporting the body in the kneeling position is obtained.

Since the establishment of the Volunteer Rifle Force, targets for rifle practice have formed a fruitful subject for inventors. Three different constructions of targets are exhibited in Class XI., viz.:—The electric target of M. Chevalier; another by Messrs. Gisborne and Bolton; and a self-acting semaphore target by Capt. McNeile. M. Chevalier's electric target is a very ingenious apparatus. When a bullet hits any portion of the face, a hammer is caused to rebound and complete the electric circuit, through wires connected with the particular plate that has been struck and also with an indicating apparatus at the firing-stand. Messrs. Gisborne and Bolton, instead of having hammers, use metallic balls, contained in tubes made of some non-conducting material, for completing the circuit. The striking of either of the face-plates by a bullet will cause the metallic ball behind that plate to run up the tube and touch the ends of two conducting wires; the electric circuit being thus completed, a current will pass to a printing telegraph at the firing station, and mark on a diagram the particular plate that has been struck. A peculiar feature of this target consists in placing the face plates in different planes, so that one bullet can never effectively strike two plates. In Captain McNeile's arrangement, which is intended to produce only a momentary indication, the face of the target is divided, like those above noticed, into compartments, formed of separate plates. Bearing against the back of each plate is a number of hammer heads, connected, by means of arms, with a central lever, which acts on a detent, whereby a weighted pulley, for operating a semaphore arm, is held fast. When a plate is struck by a bullet, one or other of the hammer heads will fly back and release the detent, and thereby allow the weighted pulley to rotate, and cause the semaphore arm, with which it is connected, to rise and indicate the plate that has been struck. This done, the detent and hammer will immediately return to their original position, and the axial motion of the pulley will be arrested; the semaphore arm will then fall out of sight, and remain quiescent until the same face plate is again struck. This target is both the simplest and least expensive in construction, and not liable to derangement, as nothing short of actual violence can put it out of order.

Recent Patents.

To THOMAS STOKES CRESSEY, *of Burton-on-Trent, for improvements in machinery used in the manufacture of casks.*—[Dated 30th July, 1861.]

THIS invention relates to machinery for shaping the ends of the staves of casks, to prepare them for receiving the head. For this purpose, after the staves have been put together to form a cask, and whilst they are held together by the hoops which are employed to hold them previous to the cask being finally hooped, the inner face of the ends of the staves is subjected to the action of a rotary cutter or cutters, suitably formed to make the groove in the staves for receiving the outer edge of the head, and also to bevil the ends of the staves, and to cut away the middle portion of the staves just above the groove, so as to make the interior of the cask at that point circular.

In Plate II., fig. 1 is a side view of a machine constructed according to this invention. *a, a,* is the frame of the machine; it carries in suitable bearings the axle *b,* on which is a fast and loose pulley b^1, driven by a band b^2, from shafting below. On the axle *b,* is another pulley b^4, which, by a band, drives the pulley c^1, on the axle *c.* This axle also carries the rocking frame *d, d,* on which is mounted the axle *e,* at the extremity of which the cutter block *f,* is fixed. This block receives cutters, such as have heretofore been employed for preparing the ends of staves to receive the head, where each stave has for the purpose been subjected separately to the action of a revolving block carrying cutters. The axle *e,* is driven by a band passing around a pulley c^1, on that axle, and also around a pulley c^2, on the axle *c.* This method of mounting the cutter block is an important feature of the invention. The cutter block projects through an opening formed for it in the standard a^1, of the frame, and is capable of being raised and lowered by a hand screw *g,* which acts on the end of the lever *h.* This lever turns on a centre h^1, on a standard springing from the frame, and is connected by the link *i,* with the frame *d.* The cask which is to be operated on is partly shown at *j.* The ends of the staves are fitted into a wooden hoop *k,* and the cask, at its end, is supported on friction rollers *l, l,* carried in bearings in a frame *m*: this frame at its ends has spring pieces m^1, m^1, fixed to it. One of these is centred to the frame at m^2, and the other is formed into a handle, and, when the cask is in its place, is hitched over a pin m^3, on the frame, so that the rollers *l,* tend constantly to press the end of the cask upwards; they thus keep it constantly against the lower edge of the wheel or disc *n,* which is capable of turning freely on a stud carried by the standard a^1. The arrangements just described, by means of which the interior of the cask is kept constantly up against a gauge, is also an important feature of the invention, as it keeps the depth of the cut uniform, whatever may be the irregularities in the form of the cask or the thickness of the staves. At the end of the stud axle, the swivel eye *o,* is also mounted: this receives a hook, shown separately at fig. 2. On the stem of this hook a cross bar, somewhat elastic, is capable of sliding. When the cask is brought to the machine, the hook is placed in the eye *o,* and the cross elastic bar is brought to bear firmly against the outer end of the cask by means of the screw nut beyond it: it thus presses the inner end of the cask against the standard a^1, or against a suitable bearing surface fixed on this standard. In order to rotate the cask, a hook is fixed on the hoop *k,* and the strap *p,* is con-

nected therewith. This strap is passed over the guide pulley *q*, to the drum *r*, which is slowly rotated by a bevilled wheel *s*, on the drum axle, gearing with another bevilled wheel on the axle *t*, on which is also a worm wheel t^1, gearing with a worm *u*, having on its axle a fast and loose pulley u^1, round which a band passes to a pulley on a shaft below. The arrangement above described, for slowly rotating the cask, is very convenient, and also forms part of the invention. The cask to be operated upon having been adjusted in the machine, as already described, and the strap around it having been arranged, so as to be capable of giving it, in unwinding, somewhat more than a complete revolution, the cask and also the cutter block *f*, are put in motion. The cutters are then set in motion by means of the hand screw *g*, the work being at the same time observed, to see that the cut is brought to the required depth; when this is done, no further adjustment is required until the cut is complete. The wheel or disc *n*, can be changed to adapt the size to that of the cask to be operated on.

The patentee claims, "the combining a machine, as herein described, for shaping the ends of the staves of a cask."

To WILLIAM LYNALL THOMAS, *of Hill-street, Berkeley-square, for improvements in projectiles.*—[Dated 11th September, 1861.]

THIS invention relates to the construction of an elongated projectile, with a leaden or other suitable soft metal jacket, which is expanded by means of an iron or other hard metal sabot.

In Plate II., fig. 1 is a longitudinal section of a shot made according to this invention; fig. 2 is an elevation of the same, with the soft metal removed; and fig. 3 is a vertical section through the lines *x*, *y*, of figs. 1 and 2. *a*, is the body of the shot, made of cast iron; *b*, *b*, are irregular surfaces for holding on a leaden jacket, and b^1, b^1, are steps at the rear end of the shot. The line *v*, *w*, indicates the ovalized portion, both in the projectile and sabot; *c*, is the iron sabot at the rear end of the shot, and *d*, *d*, are steps on it, corresponding with those marked b^1, b^1, on the shot itself; *e*, *e*, are annular spaces between the tail of the shot and the sabot; *f*, is the lead or other soft metal between the sabot and the head of the shot: the space *g*, between the sabot and soft metal is filled with some lubricating material, as also the annular groove *h*, in the soft metal. When the projectile is used as a shell, a space, included within the dotted lines *i*, *i*, is left in the casting, for receiving the charge.

The patentee claims, "the construction of elongated projectiles, as hereinbefore described, with a leaden or other soft metal jacket, which is expanded when the explosion takes place, by an iron or other hard metal sabot, acting as described."

To FREDERIC MAITLAND RANSOME *and* ERNEST LESLIE RANSOME, *both of Ipswich, for improvements in treating stone, bricks, and other surfaces, and in the manufacture of filters.*—[Dated 16th September, 1861.]

IN treating stone, bricks, and other surfaces, for the purposes of this invention, the patentees employ powdered glass or other vitrified or hard

substance, or powdered flint, or powdered stone or sand mixed with soluble silicate, with or without coloring matter; the object being so to apply soluble silicate that it may for the most part be retained in combination with the pulverized substance on the surface of the stone, bricks, or other substances to which it may be applied; and this is effected by the admixture of the pulverized substances with it. The compound of soluble silicate and pulverized matter having been applied to the surface of the stone, bricks, or other material, the soluble silicate is then rendered insoluble, in like manner to that practised when impregnating stone or other substances with soluble silicate; but, by this mode of treatment, the pulverized matters will be combined with the silicate (which is rendered insoluble) on the surface of the stone; thus preserving it better from the effects of atmospheric influences than when soluble silicate alone is used, and is then rendered insoluble therein, as has been before practised.

When making parts of filters of pulverized stone, sand, or other materials cemented by soluble silicate, and also when using other porous stone or material, such porous matters are formed into hollow triangular forms or tubes, by which more extended filtering surfaces within a given space are obtained, than can be obtained by other constructions of filters; and such triangular tubes may be combined at pleasure, according to various arrangements.

For treating stone, &c., by this process, fine silicious sand, or powdered glass, or pulverized flint, or pumice stone, or other suitable hard or mineral substance is employed, which is intimately mixed with a solution of silicate of soda or potash, of a specific gravity of about 1·200 or 1·300, into a consistence resembling paint, which is then applied by brushes in the ordinary way of coloring or painting; or, when desired to produce a colored or tinted surface, as much of the coloring matters, such as are usually employed in distemper coloring or in ordinary painting, are incorporated with the sand, or powdered glass, or flint, or pumice stone, or other suitable hard or mineral substance and silicate, as the case may be; and, when sufficiently dry, a solution of chloride of calcium, generally, by preference, of a specific gravity of about 1·300 or 1·400, is applied,—care being taken, in such application, that the solution of chloride of calcium shall float as freely and as evenly as possible over the whole surface previously treated with the compound of silicate and sand, &c., without in any way removing or disturbing any portion thereof; the principal object of such application being to effect a chemical combination of the chloride of calcium with the soluble silicate of soda or potash, and to produce thereby an insoluble silicate of lime, enveloping and firmly cementing the particles of sand, glass, flint, pumice stone, &c., to the surface to which the same has been applied. Other solutions may be employed, such, for instance, as chloride of aluminum or barium, which, in combination with a soluble silicate of soda or potash, will form an insoluble silicate of alumina or baryta; but, although it is generally preferred to use a solution of chloride of calcium, on account of its being more easily obtained at a lower price, yet the application of any solution which shall be capable of combining with the soluble silicate of soda or potash, so as to form an insoluble silicate, is claimed. In the manufacture of filters, or parts of filters, the patentees take of clean silicious sand 6 parts, and pulverized clay 1 part, which are intimately mixed with a sufficient quantity of silicate of soda of specific gravity of about 1·700, to bring the mixture into a plastic state suitable for

moulding. This mixture is then pressed into suitable moulds, fitted with plugs or cores, so as to form hollow bars or tubes of a triangular form in section, as represented in figs. 1, 2, and 3: these hollow bars or tubes are then removed from the mould, and are allowed to dry gradually, after which they are placed in a suitable kiln, and heated to a bright red heat; when they are allowed to cool gradually before being exposed to the external atmosphere. These hollow bars or tubes may be employed either singly or in a series of connected bars or tubes covering any required surface; or they may be employed in layers fitting one upon another, and merely separated by loose sand or shingle, so as to allow the water to percolate freely alike on all the sides of the triangular bars or tubes. When employed singly for ordinary household purposes, the ends of the hollow bar or tube are fitted with stops or plates, one of which is provided with a pipe to carry off the filtered water after it has percolated through the sides of the hollow bar or tube, as shown in fig. 1. When employed in combination, for filtering large quantities of water for manufactories or other purposes, any number of the bars or tubes may be joined together, to form continuous lengths, which are placed side by side, as shown also in fig. 2, or placed in layers, as shown in fig. 3. In both of the latter arrangements the filtered water is discharged from the inside of the bars or tubes into a convenient receptacle or reservoir provided for the purpose.

The patentees claim, "the manufacture and use of the hollow triangular bars or tubes in the construction of filters, or parts of filters, above described."

To JOHN GRAHAM, *of Devonport-street, Commercial-road East, for an improved double-acting force or lift pump for ships, fire engines, and other purposes.*—[Dated 19th September, 1861.]

THIS invention consists of a double-acting force or lift pump, constructed with two chambers, and with two buckets or plungers working in each chamber. The rod of the bottom bucket or plunger in each chamber works through an orifice in the upper bucket or plunger made water-tight by means of a moveable brass packing, so as to allow the rod to work in it without a parallel motion. At the side of each chamber, or connected with it, an auxiliary chamber or suction pipe is made, with a suction valve at the bottom of it, for admitting water during the ascent of the upper bucket, the water being admitted through a suction valve at the bottom of the working chamber during the ascent of the lower bucket; and when one of the valves for admitting water is open, the other is closed. The water raised by the lower bucket of each pump is forced through an opening furnished with a valve into a reservoir placed between the working chambers, or in any convenient position; and the water raised by each of the upper buckets passes over the top of the working chamber into the same reservoir.

In Plate II., fig. 1 is a vertical section taken through both of the chambers of a pump, showing the working parts of it; and fig. 2 is a vertical section taken through one of the chambers, and in the line N, O, fig. 1. A driving lever X, X, made double in the middle, is fixed at its centre on the centre shaft *a*, and at each end of it is fixed a handle, as shown. The beam C, is also fixed upon the shaft *a*, in the same direction

as the driving lever X, X; so that when the driving lever X, X, is moved, the beam C, shall have similar motion given to it. D, is a tumbling lever, with a stud pin at the end of each of its arms, and on these stud pins are mounted friction rollers. The tumbling lever is mounted, and rocks upon the centre shaft *a*, and the rollers at the ends of its arms move in a segment of a circle, and in two slots in the beam E. The working parts of the pump are all enclosed in a water-tight case, having an inlet for the water at K, and an outlet at M. On the under side of the beam C, and at its centre, is fixed an arm, and at the end of that arm is a stud pin, carrying a friction roller, which works in a short vertical slot in the tumbling lever, so as to give motion to that lever when the beam C, is moved. The friction rollers at the ends of the arms of the tumbling lever work in the slots of the beam E, E, so as to cause that beam to rock on the centre shaft A, in a direction the reverse of the beam C. H, H, are the spears or rods of the buckets or plungers; I, I, are the buckets; and J, J, are the suction or foot valves; K, is the suction nozzle, to which is to be attached a suction pipe, through which the water is to be drawn into the machine. Upon being drawn into the machine, the water passes down into the space Z, Z, under the valves J, J, J, J, and is there drawn into the working chambers R, and auxiliary chambers *r*, *r*; L, L, are escape or delivery valves, through which the water is forced into the reservoir *y*, *y*, by the action of the lower buckets, when the water passes from the working chambers through the orifices P, P, into the auxiliary chambers *r*, *r*, and so through the valves L, L. The water raised by the upper buckets passes over the tops of the working chambers into the reservoir *y*, *y*, and the water passes out of the machine at the nozzle or opening M, to which a pipe may be attached, in order to force the water and convey it to the place of its destination.

To EDGAR BREFFIT, *of King William-street, City, for improvements in machinery employed in cutting hollow and solid corks.*—[Dated 2nd October, 1861.]

THIS invention consists in arranging the position of the slab of cork to be cut, so that, on being presented to the cutter, the cutter may enter at proper intervals, leaving sufficient material to present for the second cut, to form the hollow or cylindrical cork of equal thickness throughout, and the inner and outer circle truly concentric.

In Plate II., fig. 1 is a side elevation of the improved machine. A, is a guide, which fits into the end of the mandril B; on the bed or table C, of this guide, a slab of cork is placed, its proper height and position being regulated by the slot and set screw, as seen at D. The workman then presents the cork at one end of the slab to the cutter, and forms the first pellat or solid cork; the slab is then pushed along the table of the guide until the nearest edge of the perforation arrives at the upright bar E, when the second pellat is formed; and so on, till the whole slab is perforated. By bringing the edge of each perforation to the upright, an uniform distance is ensured, so that enough and no more space is left than is required for the next operation of forming the hollow corks, and a more economical use of material is thereby gained. To form the hollow cork, the perforated piece is presented a second time to the cutter, when another form

of guide or plunger F, (fig. 3) is used, which—fitting into the sliding mandril B, and working truly concentric with the cutter G,—is passed through each perforation by the workman; and a second cut is made, and a hollow cork formed, as seen at H (fig. 3). K, is a moveable hub or collar, which is kept firmly in position by means of the set screw L; this hub, striking against the standard I, regulates the depth of the cut. H, is a square or slab of cork, the thickness of which is regulated by the intended length of the cork, one side of which is presented to the cutter, and the other beard against the disc M.

Fig. 2 is a front elevation of the guide; E, the upright bar by which the distances for the cutter are regulated for perforating the cork; C, the table or bed on which the belly or best side of the slab of cork is laid; D, the set screw by which the height is regulated for presenting to the cutter. Fig. 4 shows a perforated slab of cork, after having passed through the two operations described; N, showing the first or solid cork, and O, the second or hollow cork.

Fig. 5 is a plan view of the arrangement for cutting tapered or conical corks; for this purpose, the conical stem *a*, is attached to the shaft of an ordinary lathe-head, having at its tapered end a disc *b*. On the end of the screw mandril *c*, is fixed another stem *d*, a disc *e*, being at its end also, but working on a centre, in order that it may revolve: the mandril being withdrawn, one side of a square of cork *f*, of the necessary size, is placed against the disc *b*; the disc *e*, of the mandril is then pressed against the opposite side, two or three sprays or points being fixed in either disc, which prevents the cork from moving when revolving. The taper of the cork is determined by the angle which the table *g*, forms with the under bed *k*, in an ordinary slide-rest, which fixes the point *h*, at the same obliquity as the edge of the table is to *k*. Motion is given to the cork by the pulley *i*; and the handle *l*, of the rest being turned, the cutting-point *h*, enters the cork, and cuts through it in the direction of the dotted lines, as seen in the square of cork *f*.

The patentee claims, "First,—the application of the guide (figs. 1 and 2), together with the part F (fig. 3), as before described, for the purpose of cutting hollow and solid corks, whereby a more regular manipulation is ensured, and a saving of time and material obtained. Secondly,—the arrangement of the parts shown by the letters *g*, *h*, *k*, in connection with the parts shown by the letters *a*, *b*, *c*, *d*, *e*, for the purpose of cutting tapered or conical corks."

To WILLIAM EDWARD NEWTON, *of* 66 *Chancery-lane, for an improved apparatus for heating the feed water of steam engines,—being a communication.*—[Dated 10th October, 1861.]

THE object of this invention is to heat the feed water of condensing or non-condensing engines in which the steam is used expansively. This is effected by withdrawing a portion of the steam from the induction side of the piston, by means of additional eduction valves, after the passage of the steam from the boiler to the cylinder has been intercepted, but before the end of the stroke of the piston, and before the eduction valve begins to open.

In Plate I., fig. 1 is a longitudinal elevation of the present improvements, with a slide valve to open and close the additional eduction valve

openings; the slide valve, the heater, the pumps, and pipes being shown in section; and fig. 2 is a cross section of the slide valve, with its chest, and of the heater. A, and B, are valve openings made at opposite ends of the cylinder, and opening from it into the valve chest C; D, and E, are the valve openings in the seat of the valve chest, opening from the valve chest into the heater; F, is a slide moving backwards and forwards in the valve chest. This valve is made to fit accurately in the valve chest, and the circular top is packed against the chest, so that there is no pressure on the top of the slide, nor any communication between the two ends of the chest. G, is a crank that moves the valve F; H, is the heater communicating with the upper end of the cylinder by the additional eduction valve opening A, and with the lower end, by the additional eduction valve B. I, is a pipe leading from the injection pump to the heater; K, is the injection pump, for injecting water into the heater; L, is a weight for loading the delivery valve, in order to prevent the water from being drawn into the heater in undue quantity, whenever a partial vacuum may be formed there. M, is the pipe leading from the heater to the withdrawing pump; N, is the withdrawing pump; O, is the hollow plunger of the withdrawing pump; P, is the valve in the hollow plunger; Q, is the stuffing box of the pump N; R, is the stuffing box of the pipe S, leading from the withdrawing pump to the boiler; T, is the cock for discharging air and water from the heater; U, is a dial for noting the number of degrees that the crank or shaft of the engine revolves; V, is the main shaft of the engine; W, is the main crank of the engine; Z, Z^1, Z^2, and Z^3, show circular dishes, that can be placed in the heater, for the purpose of exposing a greater amount of surface of water to the steam. The water falls from the inner edge of Z, into Z^1, then from the edge of Z^1, into Z^2, and from the edge of Z^2, into Z^3, and then from the edge of Z^3, into the bottom of the heater,—the water thus falling successively from dish to dish. The crank revolves in the direction of the arrow marked on the dial. The operation is as follows:—When the crank W, revolving in the direction indicated by the arrow, arrives at the position W^1, drawn in dotted lines, it is seventy degrees from the lower centre; and the piston moving at the same time from the top towards the bottom of the cylinder, as indicated by the arrow, has completed about $\frac{67}{100}$ of its stroke, the passage of the steam from the boiler to the cylinder being supposed to have been previously intercepted. Then the small crank G, working the valve F, will be at the position G^1, shown by the dotted lines, and the valve F, will be upon the point of uncovering the passage D, and opening the passage from the induction side of the piston through the opening A, and valve chest C, to the heater H. When the crank W, arrives at the position in which it is drawn in full lines, it is then forty degrees from the lower centre, and the piston has completed $\frac{82}{100}$ of its stroke, and the small crank G, will then be at the extremity of its throw, and the slide valve F, will be wide open, as represented. When the crank W, arrives at the position shown in dotted lines by W^2, then it is ten degrees from the lower centre, and the piston has completed $\frac{99}{100}$ of its stroke, and the small crank G, will be at the position shown in dotted lines at G^2, and the valve F, will have just closed the opening D, and the communication between the cylinder and heater. The upper eduction valve commences to open after the upper additional eduction valve has closed, and thus the steam in the heater can never pass into the condenser.

As the upper eduction valve commences to open when the crank is ten degrees from the lower centre, a certain degree of lead is given to this valve. The operation on the return stroke of the piston is the same, the other end of the slide F, marked F^1, opening and closing the passage E.

Fig. 3 is a front elevation of the puppet valves placed at the ends of the cylinder (to open and close the additional valve openings), together with the machinery for raising and lowering the valves and their chest; the upper additional eduction valve is attached to the lifting rod *c*; and the lower additional eduction valve is attached to the lifting rod *d*. *e*, is a foot attached to the rod *c*; and *f*, is a foot attached to the rod *d*; *g*, is a tappet that raises and lowers the valve in the upper cylinder; and *h*, is a tappet that raises and lowers the valve in the lower cylinder; *i*, is a rock shaft, on which the tappets *g*, and *h*, are attached; motion is communicated to it by a small crank placed on the main shaft of the engine. The valves in the upper and lower cylinders open and close, while the crank revolves the same number of degrees that it has been shown to do when the operation of the slide valve was described. One additional eduction valve can be made to lead the steam from the cylinder to the heater on both strokes of the piston, by being placed midway between the top and bottom of the cylinder, so that the piston passes the port of this valve in the course of each stroke. Fig. 4 is a side elevation, showing the additional eduction valve attached to the middle of the cylinder, the excentric rod and the machinery that opens and closes the additional eduction valve, and also showing the diaphragm, the cup, and the weight in the heater; 1, is the cylinder of the engine; 2, is the upper port of the cylinder; 3, is its lower port; 4, are small round holes, forming the port of the additional eduction valve. The size of these holes in the direction of the length of the cylinder should be less than the narrowest packing ring of the piston. 5, is the valve chest of the additional eduction valve; 6, is the additional eduction valve. This valve is here represented by a double-beat Cornish puppet valve, although a single valve properly weighted would answer, or a slide valve could be used; but it should, after being opened by the tappet, be brought back by a spring or weight in the same manner that the additional expansion valve is operated in many marine engines. The aggregate openings of the small ports 4, must, of course, be equal to the opening of the valve 6. 7, is the lifting rod that lifts the valve 6. V, is the main shaft of the engine; W, is the main crank; U, is a dial, showing the number of degrees that the crank moves; 11, is the excentric wheel that works the main valves of the engine; 12, is the excentric rod of the wheel 11; 13, is a bar worked by the excentric rod 12, by means of the small hook 14, and having a motion parallel to the motion of the excentric rod; 15, is a tappet placed on the bar 13, and acting against the lifting rod, and thus opening the additional eduction valve; 16, is the excentric hook that works the main valve of the engine. When this excentric hook is unhooked it also unhooks the small hook 14, and thus the additional eduction valve is thrown out of gear whenever the main valve is. 23, is the heater; 24, is the diaphragm, and 25, a valve placed therein; 26, is a lever; 27, the cup; and 28, is a weight at the end of the lever 26; 29, is the pipe of the injection pump, and 30, the pipe of the withdrawing pump; 31, is the pipe leading from the cylinder to the eduction valve 6. P^1, indicates also on the dial the position of the crank, when the piston is at the upper end of the cylinder; and P^2, its position when the piston is at the

lower end of the cylinder. The crank w, is shown by the dial forty degrees from the end of its stroke, the piston being then near the bottom of its stroke. The additional eduction valve 6, is shown wide open, having been raised from its seat by the tappet 15, placed on the bar 13, and worked by the excentric rod 12, which is represented midway in its throw. The tappet 15, is so proportioned that it will lower the valve before the piston gets to the bottom of its stroke. When the valve is wide open, as shown, the steam from the induction side of the piston can pass through the small holes 4, and through the valve 6, into the heater. On the return stroke of the piston, after it has passed the small holes 4, and when near the bottom of the cylinder, the tappet 15, will, on its return, raise the valve 6, and allow steam from the induction side of the piston to enter the heater. A cup 27, placed directly under the pipe leading from the injection pump, to render it certain that is will always remain full of water, is shown to be used for the float. This cup is so counterbalanced by the weight 28, that whenever any accident happens to the withdrawing pump, and the water rises in the heater, then it will also rise and force the valve 25, to close the opening in the diaphragm; and the injection pump, after having filled the heater below the diaphragm, will force the water through the heater and through the valves of the withdrawing pump into the boiler. Instead of using the tappet 15, placed on the bar 13, a smoother motion can be obtained, by making the excentric rod work an arm, which, by its vibration, works a toe or tappet placed on a shaft.

Fig. 5 is a side elevation of the machinery for raising the additional eduction valve, by a vibrating tappet. 17, is an arm that receives its motion from the main excentric rod, by means of the small hook 14; 18, is the arm of the shaft, on which the vibrating tappet 19, is placed; 20, is a small connecting rod, connecting the two arms 17, and 18; 22, are small pins placed on the small excentric hook 14, to prevent the tappet 19, from falling too low when the hook 14, is thrown out of gear. The arm 17, is shown connected to the arm 18, in such a manner that the arm 18, is at the end of its vibration while the arm 17, is in the centre of its arc of vibration, and thus the arm 18, makes two vibrations, while the arm 17, makes but one. Thus, when the arm 17, is in the position shown by dotted lines at either end of its arc of vibration, the toe or tappet 19, is depressed to its greatest extent, as shown in 21, by dotted lines. When the arm 17, passes to the centre of its arc of vibration, the tappet 19, is at its greatest elevation, and the valve is then wide open. When the arm 17, arrives at the end of its vibration, the tappet 19, is again at the position 21, (its point of greatest depression) the tappet 19, being thus at the point of its greatest depression, shown in dotted lines at 21, while the arm 17, is at both ends of its arc of vibration. The additional eduction valve can be made on the sides of the ordinary slide valve. To do this, the valve has a certain degree of lap or cover on the eduction or exhaust side, to retard the lead of the exhaust, and the additional openings are formed in the valve seat the same width, or nearly the same width, as the lap; and the corresponding openings are placed in the slide, so that the communication between the cylinder and the heater is wide open when the slide valve is in the centre of its throw or motion, and continues open during the short interval that the added lap retards the exhaust. The openings in the valve seat lead to the interior of the cylinder, by small openings made in the cylinder at or near the middle of its length, so that the piston

passes these openings on each stroke; and as the additional eduction valve never begins to open until the piston has completed more than one half of its stroke, and has passed these small openings, the steam will pass from the cylinder to the heater, through the same valve openings on both strokes of the piston.

Fig. 6 is a horizontal view of a common locomotive engine slide valve and its seat. A portion of the valve is represented removed, as indicated by the broken line, so that the openings in the seat may be visible; the additional valve openings in the sides of the slide valve and of its seat are also shown. Fig. 7 is a section of the same, showing the main valve openings; and fig. 8 is another section, showing the additional eduction valve openings; 32, is the opening on the valve seat leading to one end of the cylinder; 33, is the opening on the valve seat leading to the other end of the cylinder; 34, is the middle opening in the valve seat leading to the exhaust pipe; 35, (drawn in dotted lines) is the lap or cover added on the eduction side of the valve; 36, 37, and 38, are narrow additional openings in the valve seat, connected together at 39, (fig. 8) and then communicating with the interior of the cylinder through small round holes placed in the centre of its length; 40, and 41, are the additional eduction openings in the valve seat, connected together and leading to the heater. 42, is a chamber on each side of the slide valve, connecting the openings in the valve seat leading to the heater. The valve is represented at the middle of its motion, and the openings forming the additional eduction valves are shown wide open. These openings are equal in width to the added lap, namely, three-eighths of an inch, and they will open and close while the valve moves through a space twice the width of the opening, or three-quarters of an inch. The openings 36, 37, and 38, are three-eighths of an inch wide by two inches long, and are made three in number on each side, in order to get the necessary area without increasing too much the size of the valve. If only one opening on each side were made, it would have to be six inches long instead of two inches. The additional eduction valve can be formed by a separate valve placed in a separate chest, instead of being placed on the sides of the main valve. As the pressure of the steam through the apertures 36, 37, 38, 40, and 41, all tend to force the valve 43, upwards from its seat, steam from the boiler is introduced into the valve chest, to keep the valve 43, on its seat, by applying pressure on the top of the valve. The water can be withdrawn from the heater and forced into the boiler by an ordinary force pump, but the pump shown is preferable, as it withdraws the air from the heater with much more certainty than an ordinary pump, and allows it to pass up through the hollow plunger. And for the purpose of rendering this action more quick and certain, the capacity of the withdrawing pump should be made larger than that of the injection pump.

The patentee claims, "First,—the combination of additional eduction valves opened and closed in a regulated period of time, as herein set forth, (this period commencing after the passage of the steam from the boiler to the cylinder has been intercepted, and ending before the end of the stroke of the piston, and at or near the time the eduction valve of the engine begins to open) with a heater communicating with the cylinder by the additional valves, but closed against the atmosphere, and with a pump, or its equivalent, for withdrawing the water from the closed heater. Secondly, —the combination above mentioned in combination with a pump for inject-

ing water into the heater. Thirdly,—weighting the delivery valve of the pump that injects the water into the heater. Fourthly,—the combination of the additional eduction valves, injection pump, and closed heater, with a lifting withdrawing pump. Fifthly,—the combination of the additional eduction valves, injection pump, and closed heater, with a plunger pump having a valve placed in the hollow plunger, and having the plunger packed by two stuffing boxes. Sixthly,—retaining the additional eduction valves on their seats when the pressure of the steam on them is alternately in opposite directions, and also the mode herein set forth of effecting this object. Seventhly,—the use of an additional eduction valve communicating with the cylinder of a steam engine, by an aperture placed at or near the middle of the length of the cylinder, in combination with apparatus for heating the feed water of steam engines by steam withdrawn from the induction side of the piston. Eighthly,—forming the aperture last named by a number of small holes pierced through the middle of the cylinder. Ninthly,—opening and closing the additional eduction valve when placed in the middle of the cylinder, by a motion derived from the excentric that works the main valves of the engine. Tenthly,—the use of the diaphragm in the closed heater, and the valve attached to the cup, or its equivalent, and balanced by the weight, in combination with apparatus for heating the feed water of steam engines by steam withdrawn from the induction side of the piston. Eleventhly,—forming the additional eduction valve openings on the sides of a slide valve and its seat, and arranging them so as to be wide open when the valve is midway in its throw, and also so as to lead to an aperture made in the cylinder at or near the centre of its length. Twelfthly,—forming the additional openings last mentioned in a separate valve chest, and then keeping the valve on its seat by the full pressure of steam from the boiler on the top of the valve. Thirteenthly,—making the withdrawing pump larger than the injection pump."

To HENRY NELSON, *of Manchester, for improvements in machinery or apparatus for punching washers for throstles and other similar purposes.*—[Dated 12th October, 1861.]

THIS invention consists of two rollers, revolving in suitable bearings, between which the cloth or material to be punched passes. On one of the rollers are projecting cutters, so that as the material to be perforated comes in contact with each cutter, the requisite hole is punched; and to cause the material to pass between the rollers regularly, without slipping, one or both of them are grooved or fluted, and at the front of the apparatus any suitable guides may be fixed to keep the material in a straight direction.

In Plate I., fig. 1 is a transverse section, and fig. 2 a front elevation, of the improved machinery for punching washers of cloth or other material, for throstles and other similar purposes.

The rollers, between which the cloth to be punched passes, are shown at *a*, *b*, having shafts *c*, *d*, which work in the bearings *e*, attached to the small frame or table *f*. The shafts *c*, *d*, are geared together by toothed wheels *g*, *h*, in order to give simultaneous motion to the rollers, and at the opposite end of the lower roller there is a toothed wheel *i*,

gearing into the pinion *k*, fixed to the driving pulley *l*, which, with the loose pulley *m*, work loose on the stud *n*. The bottom roller *b*, is fluted, and has fixed to it the punchers or cutters *o*, at the required distance apart. The top roller *a*, is made of soft metal, so as not to injure the cutters when they project through the cloth or material, and the top roller is adjusted to its proper distance from the bottom roller by set screws *p*. At the front of the rollers there is a guide *q*, for maintaining the cloth in a straight direction.

The patentee claims, "the employment of cutters or punches, fixed to a plain or fluted roller, acting in concert with a soft metal roller, for the purpose of punching washer cloth or other material for throstles and other similar purposes, as described."

To WILLIAM SMITH, *of Salisbury-street, Adelphi, for improvements in the apparatus for, and method of, increasing the illuminating power of gas, —being a communication.*—[Dated 17th October, 1861.]

THIS invention relates to a novel apparatus for increasing the illuminating power of gas, which consists of a chamber or vessel, through which the gas is caused to pass and circulate, previously to its being consumed. The said apparatus, materials employed in conjunction therewith, and the method of using or employing the same, as hereinafter described, is combined with the use or employment of benzoine, as an agent for increasing the illuminating power of gas to any required degree.

The figure in Plate I. is a vertical section of an arrangement of apparatus constructed in accordance with the present invention, for the purpose of impregnating gas with benzoine, to increase its illuminating power on its way to the burners.

In this apparatus, a capillary arrangement is shown for producing an atmosphere of volatile hydro-carbon, consisting of cotton wicks contained within a series of round tubes; but tubes of other forms, or sheet spaces alternately disposed or arranged, so as to increase the length of, or passage for, the travel of the gas, from its entry to its exit, may be substituted for detached or separate tubes arranged in rows. The tubes or sheet spaces are attached to, and by preference should project slightly below, the diaphragm, division plate, or horizontal partition, by which the lower part of the chamber containing the supply of liquid carbon or illuminating fluid is separated from the upper part or portion of the apparatus, through which the gas has to pass on its way to the burners. For the sheet spaces, a series of wicks or strands may be employed, side by side, or sheets of such materials, or loosely felted materials may be introduced, one end through the tubes, or openings, into the lower chamber, whilst the other end depends freely from the upper end of the tube or opening, and falls upon, or towards, the upper side of the horizontal diaphragm or division plate, and, by the action of capillary attraction, is maintained in a moist condition. The strands being charged with the liquid carbon, or illuminating fluid, and being of open structure, the gas is made to pass in contact with the moist surfaces thus opposed to the direct passage of the gas from the inlet to the outlet pipe.

a, is the case of the apparatus; *b*, the reservoir, which is connected by means of an opening with the lower part of the case *a*; *c*, is an inlet pipe,

and *d*, an outlet pipe from the case; *e*, being a connecting or circuit pipe, by means of which the gas may be passed direct from the supply to the burners, when the connection between the supply-pipe and the apparatus is shut off; *f*, *f*, are the wick tubes; *g*, the diaphragm or division plate; *h*, the opening between the chamber formed by the diaphragm *g*, and the reservoir *b*; *i*, a discharge cock, inserted in the bottom of the case *a*; *k*, a cock inserted in the circuit pipe; *l*, the inlet cock of the pipe *c*; *m*, the outlet cock of the pipe *d*; *n*, *n*, the capillary wicks, or other form of material.

The patentee claims, "improvements in the apparatus for, and method of, increasing the illuminating power of gas, by means of a box containing capillary arrangements or apparatus, as herein described, for producing an atmosphere of benzoine vapour, for the purpose of charging the gas passed there through, as herein set forth. Second,—the use or employment of the capillary arrangement or apparatus, as herein described, whether benzoine or any other liquid carbon can be employed for the same or similar purpose."

To CHARLES CHEYNE, *of Great George-street, Westminster, and* THOMAS BEEBY MOSELEY, *of Lewisham, Kent, for improvements in the construction of apparatus for signalling on railways, by which improvements the signalling apparatus is rendered self-registering or recording, and also applicable for measuring and recording the speed of passing trains, and the time of their passage; part of which improvements is applicable for recording the speed of trains where signalling is not required.*—[Dated 18th October, 1861.]

IN constructing apparatus for signalling on railways according to this invention, the patentees place at or near each of the ordinary semaphore signal posts, by preference in a room in the vicinity thereof, an instrument containing a train of wheels kept in motion by a spring or weight, by means of which a strip of paper may be propelled continuously and approximately at a regular speed past a number of marking instruments; each of these marking instruments is put in connection with an electro-magnet or similar electric apparatus, which, when an electric current is passed through a wire of which there is one corresponding with each marker, moves its marker and brings it into contact with the travelling strip, thus producing a mark thereon. The instrument is also furnished with a galvanic battery, the poles of which are connected with the several electro-magnets or similar electric apparatus; but the electric current does not at all times flow through the magnets or electric apparatus, a gap being left in each of the circuits; and these gaps are bridged over from time to time to complete the circuits, when it is desired that the current should pass, and that the markers should mark the paper.

In Plate II., fig. 1 is a longitudinal section of the apparatus; *a*, *a*, are two brass plates or frames, carrying between them an axle *b*, on which is mounted a chain wheel *c*, from which depends a weighted chain. The axle *b*, by means of suitable spur wheels and pinions, drives the axle *d*, which in turn drives the axle *e*, and this gives motion to the paper roller *f*, there being a worm wheel on the axle of this roller, and a worm gearing therewith on the axle *e*. The paper is led from the drum *g*, under the

roller *f*, and is pressed against it by the two pressing rollers *h*, which are kept up to the surface of the roller *f*, by springs, h^1, h^1, so that as the roller *f*, revolves, it carries the paper onwards with it; the paper passes away to the drum *i*, and is wound thereon; this drum is driven by the band *j*, passing to it from the drum *g*. The size of the pulleys round which this band passes is so adjusted that the drum *i*, shall always be driven at a sufficient speed; any excess of speed of the band causes it to slip on one of its pulleys.

The manner in which the chain is passed over the chain wheel *c*, is shown at fig. 2, in which *k*, is an endless chain; *l*, a weight attached to a pulley l^1; and *m*, another chain wheel, shown also in fig. 1; the chain passes also over this wheel, which is turned only for the purpose of winding up the apparatus: at other times it is held stationary by a ratchet and click. The length of chain and the gear wheels are so arranged that the apparatus shall run, by preference, about thirty hours; the paper travelling at a speed of about one inch per minute; the speed of the paper, however, may be much varied; it will seldom be convenient to make it less than half an inch per minute, or more than four inches.

A plan of a portion of the apparatus is shown at fig. 3; *n*, *n*, are standards carrying the paper rollers; *o*, *o*, are four marking levers: they have tubes o^1, o^1, fixed on them, through which screws or pins pass; these are fixed into the standards *n*, and serve for the levers to turn upon. *p*, *p*, are armatures fixed on the levers *o*, and immediately under them are the poles of the electro-magnets *q*, *q*. o^2, o^2, are adjusting screws, which, striking against a pillar or stop, serve to prevent the armatures coming in contact with the poles of the magnets. Fig. 4 shows the ends of the levers *o*, with their marking points, which, as will be seen, are adjustable, so that they may be set at a proper distance from the paper. The roller *f*, is of metal, and has a small groove turned in it at each of the places where the marking points come up to it. The electro-magnets are such as are commonly used in telegraphing, but if the circuits be short, as will most always be the case, the wire should not be very fine, and no very great length will be requisite. The electric circuit is completed through one of the electro-magnets at regular intervals of time, by means of a clock, thus producing, on the travelling strip of paper, marks, from which, by simply inspecting the strip, the time at which any portion of it was passing under the markers may be determined. The time spaces are marked on the paper by the circuit being completed once every minute, an extra mark being made at the end of each half hour, and two extra marks at the end of each hour, so that it only remains for the station master, or person under whose control the apparatus is placed, to write the date upon the strip once (at any fixed time) in the twenty-four hours, to enable one to ascertain what markers were called into play at any particular hour or minute of the day.

Any ordinary clock can be made to complete these time circuits in the following manner:—Upon the spindle of the hour wheel is fixed a wheel having sixty teeth cut upon its circumference; on each side of one of the teeth, and close to it, two small strips of metal are soldered or fixed, so as to form two more teeth. At the opposite side of the circle—that is, at the thirtieth tooth from the one near which the two extra teeth are placed—one piece of metal or extra tooth is fixed. At some convenient place, close by the circumference of this "make and break" wheel, is a spring,

which presses lightly on the edge of the wheel; each tooth in succession passing under it, and completing the circuit between the battery and the electro-magnet. The spaces between the teeth may be filled in with some non-conducting and hard material, so as to prevent the spring falling from one tooth to the other. The circuit, in connection with another of the markers, is completed by the semaphore arm, each time it is raised to indicate danger. The semaphore signals complete their circuits in the following manner:—Upon some portion of the rod which works the arm of the signal, is fastened a steel or brass spring or arm, say six inches in length; this is enclosed in a casing or box, on the inside of which is a metal stud, in sufficiently close proximity to the spring for the latter to come in contact with it when the arm is raised to danger, and to remain in contact as long as the arm is so raised. The stud is connected with the wire attached to the electro-magnet, which has to record the signals indicated by the semaphore arm; the circuit of a third marker is completed by the distance signal, when it is brought to indicate danger; this may be done in a manner quite similar to that employed for the semaphore arm. The circuit of a fourth marker is completed each time a train passes the semaphore signal. For this purpose, a lever is so placed on the inner side of one of the metals, that the flanges of the engine and other wheels, in passing over it, cause it to be depressed. This lever is mounted on an axis, and the axis is produced to some distance from the line of rails, where its motion is communicated by an arm to one end of a vertical rod, say about three feet in length; the other end of this rod is made to enter a wooden or other box, in which is a spring, so constructed that the rod, in being raised by the depression of the lever, shall press it against a metal stud, to which the wire from the electro-magnet is attached; the rod, being in metallic contact with the earth, completes the circuit of the battery, and causes the marker to act. The circuit of this marker is completed similarly by a train passing the distance signal; or for this a separate marker may be employed, but this is hardly necessary.

Thus it will be seen, first, that the times of putting the semaphore and distance signals to danger are recorded on the travelling strip; marks being produced upon it, which, taken in conjunction with the time marks on the same strip, form the required record. Second,—that the length of these marks will determine how long the semaphore and distance signals were kept at danger. Third,—that the time of the passage of each train past the semaphore and the distance signals will be recorded similarly by marks on the strips, and that these marks also give all the data required to determine the speed at which any train passed either of these points (the length of the train being known); for as the circuit is kept completed from the time the train commences to pass until it is completely clear, the length of mark produced will vary inversely with the speed of the train. When the trains pass both the semaphore and distance signals, the speed is readily ascertained, even if the length of the train is unknown, as the moment the train arrives at each of these points, it is registered on the strip, and the distance between the two signals is known. It will be understood that each semaphore arm, or distance signal, of which it is desired to keep a register, will have its separate marker and line of marks on the strips, and the same is the case with each line of rails over which it is desired to record the passage of trains. An apparatus arranged as

above described, but to suit two lines of rails in place of one, will require seven markers.

Where it is not necessary to employ signals, but it is desired to ascertain only the time occupied by trains in passing over a given space of line, a similar arrangement may be employed, some of the markers and parts in connection therewith being dispensed with. If it is only required to keep a check on the speed of passing trains—as is sometimes desirable on parts of a line where high speed might be dangerous—a time marker, and two markers for each line, is all that will be required.

The battery employed consists of three or four cells—more or less, according to the length of the circuits—containing graphite and zinc plates of considerable size, say about six inches long and three broad; and with cells of large size, containing a considerable quantity of weak acid, such a battery will require but little attention to keep it in working action. One end of the coil of each electro-magnet is coupled to one pole of the battery, and the other pole of the battery is connected with the earth: the other end of the coil of each electro-magnet is connected to an insulated wire, leading, as the case may be, either to the clock, to the signal, or to the apparatus already described to be acted on by the passing trains; here a break is left in the circuit, which is completed only when the registration is to that place, and then the insulated wire is brought into electric communication with the earth by one or other of the means hereinbefore described.

To WILLIAM EDWARD NEWTON, *of Chancery-lane, for improvements in the condensers and condensing apparatus of steam engines,—being a communication.*—[Dated 11th October, 1861.]

IN those low-pressure engines in which the water of condensation is returned to the boiler in its original state, without mixing with any other water more impure than itself, there are two known plans for effecting the desired object. The first plan is the well-known surface condenser. In this the steam, after quitting the cylinder, is condensed by being brought into contact with a metallic surface, kept cool on the reverse side by the application of cold water, and, after being condensed, is returned, in the state of water, back to the boiler. The second plan is that of cooling the water that has been delivered into the hot well by the air pump—after sufficient quantity has been taken to feed the boiler—by contact with a metallic surface, kept cool on the reverse side by the application of cold water, and, after the water has been so cooled, of re-injecting it into the condenser, to condense the steam. The object of the present invention is to obtain the same effect that either of these two plans will produce, but with a less amount of surface: this is done by combining the two plans above mentioned, as it has been found by experiments that less surface will be required in combination to produce the required effect.

In Plate I., fig. 1 represents, in side elevation, an arrangement of the new combination of an external condenser with a cooler; and fig. 2 is a horizontal view of the same. A, is the ordinary condenser, and B, a pipe leading from the cylinder and side pipes to the external condenser C, which is placed between the side pipes and the

ordinary condenser. This external condenser is here formed of the small tubes *a, a, a,* through which the steam passes on entering the external condenser by the nozzle M, and leaving by the nozzle N. These small tubes *a, a,* are surrounded on the outside by a continuous supply of cold water, which enters the case D, (in which they are placed) by the nozzle E, and leaves it by the nozzle F. G, is the cooler that cools the water taken from the hot well, and is placed between the hot well and injection pipe. This cooler is here formed by two tubes *c, c,* coiled in a helical form, and surrounded by a continuous supply of cold water, which enters the case H, in which the coils *c, c,* are placed, at the nozzle at one end, and leaves it at the nozzle at the other end. L, is the injection pipe that conducts the water from the hot well to the cooler; W, is the injection pipe that conducts the water from the cooler to the ordinary condenser.

The operation is as follows:—The steam, after its escape from the cylinder, passes through the external condenser C, where it is partially condensed; then the uncondensed portion of the steam, together with the water that has been formed from the part condensed, passes on to the condenser A, where the uncondensed steam is condensed by the water from the cooler entering by the injection pipe W, in the same manner that steam is ordinarily condensed by injection.

The patentee claims, "the combination of a surface or external condenser, placed between the side pipes and the ordinary condenser of a steam engine, with a cooler for cooling the water from the hot well; this cooler being placed between the hot well and the ordinary condenser, so that the steam, after being partially condensed by the external condenser, will then be further condensed by means of the injection of the cooled water from the hot well into the ordinary condenser."

To WILLIAM EDWARD NEWTON, *of* 66 *Chancery-lane, for improvements in self-feeding inkstands,—being a communication.*—[Dated 12th November, 1861.]

IN self-feeding inkstands, there is much uncertainty of action and irregularity in the depth of dip, owing to the variable pressure, by consumption, of the column or head of ink in the reservoir that supplies the cup. To obviate such defects is the object of the present invention.

The figure in Plate I. represents a sectional view of one of the improved inkstands in the process of being filled. *a,* is the reservoir, having no opening for the admission of air, by leakage of any stopper, plug, cap, or when filling, except by a specially arranged tube or passage *b,* which forms the novel feature of the present invention. This tube or passage *b,* is arranged to form an angular connection with the partially exhausted air space, at or within the top of the reservoir, above the ink, and the pen cup *c,* at its top, or at or about the height the ink is desired to stand therein. This cup *c,* is further connected with the reservoir at or near the bottom of the reservoir and cup by the usual branch connecting tube or passage *a.* To fill the inkstand, a filler may be used, formed of a pipe *e,* surrounded near its bottom by a cork or other soft or flexible disc *f,* of sufficient size to constitute a close cover around the aperture in the

bottom of the cup, which establishes the ink connection with the reservoir. The pipe *e*, is to be made of sufficient height to admit of the ink being passed into the reservoir to nearly the full height thereof. The air will escape from the reservoir (whilst the filling is going on) by the upper connecting tube or passage *b*, which forms an air connection between the top of the reservoir and the body of the cup. No ink must be in the cup whilst first filling in the ink, if this method of filling and form of filler be adopted, and on removal of the filler *e*, the ink will rush into the cup *c*, from below, and will rise therein till it fully, or slightly more than fully, covers the lower end or bottom opening of the upper connecting tube *b*. In doing this, the ink shuts off the admission of fresh atmosphere to the interior of the reservoir A, and by thus gradually closing the admission, while the ink in the reservoir continues to descend to supply the cup, the atmospheric pressure on the ink in the reservoir is necessarily slightly reduced, and a sustaining power is obtained to keep the ink in the cup *c*, at a level slightly over or just covering the bottom opening or end of the upper connecting passage *b*, which level is continually preserved during the falling of the ink in the reservoir, to meet the drain upon it in the cup by the repeated use of the pen.

The patentee claims, "the arrangement and combination of the upper tube or passage *b*, for connecting the top or air space of the reservoir A, with the dipping or pen cup *c*, as herein set forth."

Scientific Notices.

INSTITUTION OF CIVIL ENGINEERS.

May 13 and 20, 1862.

JOHN HAWKSHAW, Esq., President, in the Chair.

The first paper read was, "*The Malta and Alexandria submarine telegraph cable,*" by Mr. H. C. Forde, M. Inst. C.E.

It appeared that in May, 1859, Her Majesty's Government determined that a telegraph cable should be laid between Falmouth and Gibraltar, and the late Mr. Lionel Gisborne and the author were appointed joint engineers. Subsequently, and after some progress had been made with the construction of the core and the outer covering, it was proposed to use the cable to join Rangoon and Singapore. This idea was, however, abandoned, and, in January, 1861, it was decided that it should be laid between Malta and Alexandria, an operation which was carried out in the summer of that year, the communication having been successfully completed on the 28th October, 1861.

The recommendations of the late Mr. R. Stephenson and Sir Charles Bright, as to the form and size of the cable to be used between Falmouth and Gibraltar, were then referred to; and it was stated that iron-covered cables, of three sizes, were designed for the varying depths up to 600 fathoms, and for the greater depths, across the Bay of Biscay, a cable

covered with twelve steel wires, each enveloped in a hempen strand, laid in a spiral form. The latter was abandoned when the destination of the cable was changed; but the other forms of outer covering were retained, as considerable progress had been made with their manufacture. If it had been known at first, that the cable would be laid in comparatively shallow water, a different design would have been adopted. The outer wires were much larger than those of the Atlantic, the Red Sea, and the other Mediterranean cables containing a single conductor, and the conductor was nearly four times the size of the Atlantic cable, and twice that of the Red Sea cable.

The contract for the manufacture of the core was intrusted to the Gutta-percha Company; the contracts for the outer covering, and for laying and maintaining the cable for thirty days after completion, were let to Messrs. Glass, Elliot, and Co. The conditions of the contracts were then given in detail, the main features being that the core and the cable were to be kept continually under water, during the manufacture and the laying, and that the electrical tests were to extend from the commencement of the manufacture until thirty days after the submersion of the whole line. The different processes involved were next described, and it was stated that, under a pressure of from 600 to 800 lbs., the electrical condition of the core improved about 10 per cent. The relative resistance per knot, both as to conduction and insulation, of the Atlantic, the Red Sea, and the Malta-Alexandria cables, was represented by the numbers 1, 4, and 37. It was requisite that great care should be observed in making the joints of the core, of which there were 4200 in the Malta-Alexandria line, as the slightest imperfection in any one would be attended with danger.

A difficulty having arisen in keeping the cable permanently under water, one portion became exposed to the air, and was allowed to dry. When tested, a loss of insulation, with increased resistance in the conductor, was observed. An investigation by Dr. W. A. Miller, F.R.S., showed that this deterioration was due to heating, from the effects of oxidation. It was consequently resolved, that the original idea of fitting the two ships with water-tight tanks should be carried out. The way in which this was accomplished, and the manner of coiling the cable on board, were then alluded to. The eye of each coil was fitted with an open framework of timber, by which arrangement a fault was cut out of the centre of the large coil, without its being necessary to uncoil the whole cable, as would have been the case with a solid eye.

Previous to commencing the operation of laying, the route was most carefully surveyed by ships of the Royal Navy, when it was ascertained that the Admiralty charts were in parts incorrect in latitude, and were deceptive as to the soundings, the general depth and the conformation of the sea bottom being very different to what they were represented to be on the official charts.

Each ship was fitted in the following manner:—A large V sheave, furnished with a small friction band, was suspended above the centre of the hold, and over this the cable was led. The paying-out apparatus, placed on one side of the stern, consisted of three V sheaves, in one vertical plane, and parallel to the centre line of the vessel; each sheave being provided with a friction strap. The cable was passed over these sheaves under three weighted jockey pullies, to the brake drum, round which it took three or

four turns; then over a fixed sheave, and under a moveable weighted pulley, into the sea, over a fixed stern-wheel at the level of the last sheave. The dynamometer employed was similar to that used on the occasion of the successful laying of the Atlantic cable.

The first portion of this line was laid between Malta and Tripoli, the greatest depth being 420 fathoms. The cable was paid out at an average rate of 4·94 knots per hour. The maximum strain to which the heavy shore-end was subjected was 20 cwt., but with the main cable this did not exceed 12 cwt. The estimated slack paid out in the deep water was not quite 5 per cent. No difficulties of any kind occurred, until attempts were made to splice the main cable to the Tripoli shore-end, which had been laid by another ship. Nine unsuccessful attempts were made, owing to bubbles forming under the fresh gutta-percha; but by cutting off a length of 25 fathoms of the shore end, a perfect junction was effected. The remaining cable on board this ship was laid in the direction of Benghazi; the maximum depth attained being 150 fathoms, the average speed of paying-out 5·3 knots per hour, and the greatest strain 9 cwt. The cable next laid was part of the third section, commencing at Alexandria, and extending nearly 300 miles to the westward, towards Benghazi. The roughness and irregularity of the bottom rendered this operation very critical; but by carefully selecting and laying out the route to be pursued, after accurate soundings had been made, and by only paying out in daylight, it was successfully completed. Six days were occupied in laying 128·8 knots of heavy cable and 153·32 knots of main cable, or a total length of 282·12 knots. Thirty-two buoys were laid down to mark the route, and upwards of sixty different courses were run. The maximum depth of water was 102 fathoms, the minimum, for a short length, was 13 fathoms, and the average 33 fathoms. Subsequently, the second part of the third section between Alexandria and Benghazi, and the second part of the second section between Benghazi and Tripoli were laid, and the communication was established. No accurate estimate could be made of the actual slack paid out, but as a general rule, in depths under 100 fathoms, from 2 to 2½ per cent. was the utmost that could be got out of the ship when the cable was running quite free. The angle at which the cable was paid out ranged from 40° to 45°. The maximum speed was 7·15 knots, the minimum 4·5 knots, and the mean 5·25 knots per hour.

Respecting the tests during and after the laying, it was observed that as the cable was paid out, its electrical condition invariably improved; the highest resistance being found in the deepest and coldest water, and the lowest in the shallowest and warmest water. Experiments as to the rate of working showed, that the speed attained agreed very nearly with that which had been anticipated, namely, five words per minute through a length of 1100 knots, except through the short sections, where the limit of the speed depended simply upon the skill of the clerk.

The communication was accompanied by a map, showing the general course of the cable, by a longitudinal section of the sea bottom, and by diagrams of the electrical tests. Specimens of different cables were also exhibited.

The second paper read was, "*On the electrical tests employed during the construction of the Malta and Alexandria telegraph, and on insulating and protecting submarine cables*," by Mr. C. W. Siemens, M. Inst. C.E.

Having been employed by Her Majesty's Government as the electrician to superintend the manufacture and shipment of the Malta and Alexandria telegraph cable, the author was in a position to speak as to its actual state of insulation, at different stages of its progress, and as to its general superiority compared with former lines. The methods of testing differed essentially from those previously resorted to. This was the first line that had been tested systematically throughout; and the importance of an uniform and well-devised system of electrical tests being carried on during the manufacture, shipment, laying, and subsequent working of submarine cables, had been fully proved.

The covered strand of conducting wire, in lengths of one nautical mile, was placed for twenty-four hours in tanks filled with water maintained at 75° Fahrenheit. It was afterwards removed into a pressure tank, containing water at the same temperature, and when uniformly heated, it was tested for conductivity and insulation, and the result, expressed in units of resistance, noted. A pressure of 600 lbs. per square inch was then applied, and the electrical tests were repeated. Before any coil was approved, it was required that the copper resistance should not exceed 3·5 (Siemens) units, or possess 80 per cent. of the conductivity of chemically pure copper; that the gutta-percha resistance per knot at 75° should amount, at least, to 90 million units, corresponding to about 80 per cent. of the highest insulation that could be obtained with the best gutta-percha of commerce; and further, that the insulation should improve when the pressure was applied, which was invariably the case when the covering was sound. The coils were then transferred to Messrs. Glass, Elliot, and Co.'s works at Greenwich, where they were submerged in tanks until required for the sheathing machine. The sheathed cable was coiled into large tanks, and was always intended to be covered with water, but owing to a defect in the construction of the tanks, this regulation could only be partially carried into effect. It was also intended, in the first instance, that the ships should be provided with water-tight tanks to receive the cable during the outward voyage; but owing to the passive resistance with which every deviation from previous routine was usually met, this plan was not carried out, until the heating of the cable on board the S.S. "Queen Victoria" had proved, at great cost, that tanks were essentially necessary. There were other important advantages obtained through the adoption of the water tanks, by which the causes of failure in paying-out were avoided, and the operation was rendered comparatively safe and easy.

In conducting the electrical tests of the Malta and Alexandria cable in the course of its manufacture, the chief object was to obtain throughout strictly comparative results. For this purpose it was necessary to adopt a standard measure of resistance, by which to express both the conductivity of the copper conductor and of the insulating covering. The standard measure had been supplied by Dr. Werner Siemens. The unit of resistance was that of a column of pure mercury, contained in a glass tube, one metre in length between the contact cups, and of one square millimetre sectional area, taken at the temperature of melting ice. As the testing apparatus had been already described in the Blue Book "On the

Construction of Submarine Cables," it was not necessary to repeat it. In the appendix to this paper, tables were given of the results of observations upon two sections of the cable, at various stages of their progress, between Malta and Tripoli, and between Tripoli and Benghazi; and diagrams were exhibited representing graphically these results. On comparing the insulation of the cables after being laid down, with the insulation observed shortly before on board ship, there was a decided improvement after submersion. This was partly due to the pressure upon the cables, the insulation improving 2 per cent. on an average for every 100 lbs. of pressure upon the square inch, and partly to the lower temperature at the bottom of the sea.

For working the line, Messrs. Siemens, Halske, and Co. had supplied ink-recording instruments, fitted with peculiar arrangements for discharging the residuary charge of the cable, and capable of being worked by exceedingly feeble battery power. Although the line was divided into three electrical circuits, messages were transmitted mechanically and instantaneously, at the intermediate station, by a system of double relay, or translation. By this plan messages could be sent instantaneously from London to Omsk, in Siberia, and there would be no electrical difficulty in establishing the same direct intercommunication between London and Calcutta.

Respecting the construction of a cable of a more permanent character than any hitherto made, to which the author had given much consideration for many years, it was observed that, with regard to the insulating covering, nature seemed to have provided only two suitable substances—india-rubber and gutta-percha, combining permanent pliability at all ordinary temperatures, with high insulating property. India-rubber had a higher insulating power, a lower specific induction, and was capable of resisting higher temperatures than gutta-percha; but the latter could be put upon the wire in a plastic state by a die process, and gave greater security against faults than the lapped india-rubber covering. It was also less liable to receive accidental injuries, to become sticky or semi-fluid when exposed to the atmosphere, and resisted the action of water more perfectly.

The absorption of water by gutta-percha, india-rubber, and compounds of india-rubber, such as vulcanised india-rubber, Wray's mixture, and a compound with mica, under various pressures and temperatures, and from water containing different degrees of salt in solution, had been fully investigated. These experiments served to show, that an increase of pressure up to 50 lbs. per square inch, did not increase the rate of absorption, which was found to be more rapid from pure water than from sea water, and from sea water than from brine. Raw and unvulcanised india-rubber absorbed water in greater quantities than the other materials; while, next to gutta-percha, vulcanised india-rubber showed, both in fresh and salt water, the greatest insensibility to absorption.

The results of experiments on the insulating and inductive capacities of wires coated with india-rubber, in combination with gutta-percha, compared with those of special gutta-percha and pure india-rubber at different temperatures, were then given. The lengths experimented upon varied from 600 to 2500 yards. The specific resistance of special gutta-percha decreased from 9·11 at 50° Fahrenheit to 1·50 at 80° Fahrenheit, or to about one-sixth of its original value; while the combination of india-rubber and gutta-percha had, under the same circumstances, only gone down to

about one-third of its insulation at 50° Fahrenheit. The inductive capacity of the combined india-rubber and gutta-percha wire, and of pure india-rubber covered wire, was as 0·7 to 1. Notwithstanding the comparatively high insulating property of india-rubber, its low inductive capacity, and its power to resist heat, its gradual dissolution in sea water was a circumstance which alone rendered it inadmissible for submarine wires, unless it was securely enclosed in another waterproof medium, and gutta-percha appeared, in every respect, well suited for such outer covering. It was desirable that the india-rubber should be brought upon the wire without the application of heat or solvents, both of which often entailed a gradual decomposition of that material, particularly when exposed to atmospheric influence in contact with copper. Dr. W. A. Miller had stated that the liquefaction was the result of a process of oxidation, from which it might be inferred, that the effect could not take place where oxygen was excluded. It, moreover, was important to produce a perfectly cylindrical covering, and taking advantage of a peculiar property of india-rubber cohering perfectly where two fresh cut surfaces were brought together under considerable pressure, the author had constructed a covering machine which fulfilled the several purposes. Such combined india-rubber and gutta-percha covered wires had been tried under various circumstances, exposed to the atmosphere, to water, or the moisture of the ground, for nearly two years, without betraying any signs of gradual deterioration of the india-rubber, or the appearance of faults. A circumstance greatly in favour of the bi-covered wire was, that the gutta-percha shrank upon the india-rubber covered wire, and when any mechanical injury to the covering occurred, the yielding india-rubber was forced into the gap by the elastic pressure exercised by the gutta-percha, and prevented the appearance of a fault.

The outer covering of cables, as hitherto constructed, was certainly the least perfect part. An iron sheathing was very necessary to protect the insulated core in shallow waters, but for cables in more than 30 or 40 fathoms of water, the iron sheathing was an element rather of weakness than of strength: it rendered the cable ponderous, its shipment expensive, the paying-out risky, and repairs impossible; owing to the difficulty of raising a heavy cable from a great depth under any circumstances, and the absolute impossibility of doing so after corrosion of the iron wire had made some progress.

When the Falmouth and Gibraltar cable was first contemplated, the author, in conjunction with Mr. Forde, proposed to cover each iron wire with gutta-percha, with a view to prevent oxidation; but the system was not acted upon, except by way of experiment. Mere protection of the wire was, however, not sufficient, in the author's opinion. It was capable of mathematical demonstration, that in paying-out a wire-sheathed cable, with a considerable strain upon the break-wheel, it would untwist while in suspension in the water, to a considerable extent, causing elongation of the core to the amount of say one per cent., or even more. On reaching the bottom, the strain and consequent twist would be released. Copper wire could not be elongated more than 2 per cent. without receiving a permanent set; and it was also a well-ascertained fact, that when a telegraph core had been stretched at any time beyond the limits of elasticity of the copper, the latter, being henceforth too long for the more elastic covering, would tend to assume a serpentine form, and to push its way

through the insulating material by slow degrees, particularly in places where short bends or kinks occurred.

Based upon these views, the author designed a sheathing of the following description:—The insulated conductor or core was passed in the sheathing works through a series of three machines in close succession. In passing through the hollow spindle of the first machine, a close spiral covering of hemp, previously saturated in Stockholm tar, was applied in such a way, that each string was and remained under a given strain. The second machine was similar in construction to the first, but supplied a second covering of hemp wound in the opposite direction to the first. The rope, thus formed, passed next through a stationary clip, with longitudinal grooves, to prevent it from turning round in the operation immediately following, which consisted in the application, under the influence of great pressure, of from three to six strips of copper or other metal, which might best resist the action of sea water. These strips were accurately guided into the revolving covering tool, so as to overlap each other equally for nearly half their breadth; the pressure applied being sufficient to crush or socket the one metal down where it was covered by the other. This cable had no tendency to untwist; its extension, with half the breaking strain upon it, did not exceed one-half per cent., and being very strong, and of only double the weight of water, it would support about eight miles of its own weight in the sea.

Considering that good ships' sheathing lasted about ten years, when the ship was at rest, and that the cable had two layers of metal, with hardened tar between, it appeared not unreasonable to suppose, that this sheathing would last at the tranquil bottom of the ocean from twenty to thirty years at least. Several short lengths of this cable were now being tried, under various circumstances, and the results, so far, were promising of success upon a larger scale.

After the meeting, Mr. F. C. Webb (Assoc. Inst. C.E.) explained a modification of the ordinary sextant, by which larger angles could be measured than with the instruments now in use. Two sextants (by Messrs. Fletcher, of Leadenhall Street) were exhibited,—one of the common arrangement and the other on the modified principle.

It was stated, that when the arm of the common sextant was at zero, the lines of incident and of reflection of an object seen in the horizon-glass, formed a certain angle with one another, both at the object and horizon-glass; and that this angle, termed the constant angle, deducted from 180°, gave the extreme theoretical angle which could be measured. Practically, this measurement was still further reduced, by the limits within which it was possible to reflect an object from a plane surface with accuracy, and which, if assumed as 170° instead of 180°, would give the angle from which the constant angle must be deducted to obtain the extreme angle capable of being measured. The smaller the constant, therefore, the nearer would this angle approach 170°, with a given amount of accuracy. It was observed that this constant angle was dependent on the relative position of the object-glass, the eye-piece, and the horizon-glass, and was, in fact, the angle formed by a line drawn from the eye-piece to the centre of the horizon-glass, with a line drawn from the centre of the horizon-glass to the centre of the object-glass.

The reduction of this constant angle to a minimum was effected, in the modification alluded to, by placing the eye-piece very near to the object-glass, and the horizon-glass as far as possible both from the object-glass and the eye-piece. The extreme angle capable of being measured was thus considerably increased, and with conditions more favourable to accuracy; for whilst the angles of incidence and reflection in the object-glass were not smaller than in an ordinary sextant, those in the horizon-glass were constantly larger. With a given angle to be measured, the conditions were more favourable to accuracy, since the lines of incidence and reflection formed larger angles with the reflecting surfaces, both in the object and the horizon-glasses.

In marine and land surveying, and in taking altitudes of celestial objects with an artificial horizon (where the angle to be measured was double the altitude), this increase in the capabilities of the instrument was, it was believed, a manifest advantage.

INSTITUTION OF MECHANICAL ENGINEERS.

(*Continued from p.* 363, *Vol. XV.*)

The next paper read was, "*A description of Sellers's screwing machine,*" by Mr. Charles P. Stewart, of Manchester.

The screwing machine described in the present paper was designed by Mr. W. Sellers, of Philadelphia, United States, to combine accuracy of cut and greater perfection of thread than is obtained in ordinary screwing machines, with rapidity of action and simplicity of working, and with increased facility for keeping the cutting dies in good order. The screw thread is cut in a single operation, and the finished bolt is released by the withdrawal of the dies; the machine being driven continuously in one direction, without reversing or stopping.

The screw thread is cut by three dies, set radially in a die box; and the die pieces are advanced and held in the required position for threading the bolt by means of excentric ribs or cams fixed upon the cover plate. These ribs severally work in a notch in the edge of their respective dies, and, as the die box revolves—being driven from the driving shaft by a pinion and spur wheel—a projecting clutch, on the back of the spur wheel, carries round the cam or cover plate, which thus revolves at the same speed as the die box; so that the relative position of the cams and dies remains unaltered in revolving, and the dies are held up to the proper position for cutting the thread, without alteration during working.

When the thread cutting is completed, the bolt is released by the dies being all simultaneously withdrawn by means of the cams: this is effected by a second pinion gearing into the spur wheel fixed on the shaft of the cam plate. This pinion is a little larger in diameter than the driving pinion, and runs loose on the driving shaft during the time that the dies are in operation, cutting a screw; but when that is completed, the conical friction clutch between the two pinions is caused to engage by means of a hand lever, whereby the cam plate is caused to over-run the die box. The dies are thus made relatively to move back

along the cams, so that they are withdrawn from the finished bolt, which, being released, is drawn out by hand, while the machine is still driven continuously in the same direction without stopping or reversing. The hand lever, on being released, is immediately brought back to its original position by means of a counterbalance weight attached to it; thereby disengaging the pinions and pressing the loose pinion against a leather collar on the end frame of the machine, the friction of which checks the motion of the loose pinion and the spur wheel of the cam plate, allowing the die box to overtake the cam plate again: the dies are thus moved forward along the cams till they are again in their original working position, ready for cutting a fresh thread.

The adjustment of the dies to the exact position required for the size of bolt to be cut is accomplished by means of a graduated index on the spur wheel which drives the die box. This wheel is loose on the shaft of the die box, and, in working, is clamped by set screws to an arm keyed on the shaft. For advancing the dies, this arm is turned forward in the direction of the rotation, carrying the dies forward along the cams, the latter being held stationary at the time, by holding the spur wheel that is fixed on the cam-plate shaft. The dies are thus advanced to the position for cutting, and the driving wheel is then clamped securely to the arm by the set screws, having previously been turned so that the projecting clutch on the back of the wheel is engaged with the wheel of the cam plate. The machine is then ready for starting to work. The total length of the graduated index corresponds with the total length of the cams.

In order to cut a full screw thread on the bolt in once running up, the dies are cut with a perfectly full thread throughout, and of such size as to fit the bolt when it has the thread cut complete upon it. The tops of the die threads are then eased off on the side where the bolt enters, commencing at the base of the thread, and terminating at the top of the third or fourth thread from the point of entering. The thread on the bolt is thus formed by a succession of cuts, each one deeper than the preceding, until the full depth is attained.

When the machine is used for tapping nuts, the cutting dies are removed, and a tap holder is inserted in the hollow spindle of the die box, and secured from turning by a blank die, which serves as a key fitting into the notch in the tap holder.

The bolt or nut to be screwed is fixed in a holder, which slides freely on the top edge of the framing, and is furnished with a handle, made with a finger on it, to fit in a rack on the framing; this gives sufficient leverage for the momentary pressure that has to be put upon the bolt on its first contact with the cutting dies, to ensure its entrance. The clamps for gripping the bolt or nut are opened or closed simultaneously, one up and the other down, by two right-and-left-handed screws geared together by pinions and worked by a hand wheel. It is essential that the bolt or nut to be screwed, should be truly in the axis of the die box, which is ensured by boring the clamps in their places in the machine, and they are afterwards slotted to the required shape.

In cutting new dies, or re-cutting old ones, a set of master taps is used. The leading end of the master tap is supported in a circular thimble, which slides inside the hollow spindle of the die box: the dies are then pressed close upon the master tap, and the machine is

run forward and backward; the dies are again closed upon the tap, and the process repeated until a full thread is obtained.

In this machine, the necessity for setting up the dies by hand, between successive cuts, is obviated, as they are set up at the first by the graduated index of the cam plate to the exact diameter required for the finished bolt, and the screwing is completed in once running the bolt up. With each machine a table is prepared, showing the position on the index to which the pointer has to be set for cutting bolts of the various diameters within its range; and a slight change in the position of the pointer will make the bolts slightly larger or smaller, as the case may require. When the dies have become worn and have been re-cut, a re-adjustment of the index readily gives the means of bringing them up to exactly the same diameter as previously, so that the size of bolt is not altered by re-cutting the dies. The original adjustment of the index is made by actual trial of the different diameters of bolts in the machine, the results being tabulated; and this is done again when the dies are re-cut.

This screwing machine has the advantage of rapidity of action, producing a perfect screw thread in once running up, while the time usually required for running back is saved by the plan of withdrawing the dies and releasing the bolt. The machine is never required to be stopped, except for changing or repairing the cutting dies, and does not need the application of a crossed belt or reversing apparatus for driving it, since it runs continuously in one direction only. It is of small size, in proportion to the work it accomplishes, and is on a plan very convenient for the workman using it. As the dies can be readily adjusted to any diameter of bolt for which the machine is adapted, they can be worn down for a long time before requiring renewal.

Mr. Cunliffe exhibited one of the screwing machines in working order, and showed its action; also specimens of bolts screwed by the machine, and of the dies used. He said there were a good many of the machines in use in this country, besides a considerable number in America, and they had had one at work for three years at their works. The machine exhibited was the smallest size made, for screwing bolts up to 1 inch diameter, and the largest sized machine screwed up to 2 inches diameter, as shown by the specimen bolt exhibited of that size: there was also an intermediate size of machine for screwing up to $1\frac{1}{2}$ inch diameter. He showed a set of three dies, which had been in constant use for six months and had screwed 14,400 bolts of $\frac{7}{8}$ inch diameter, without ever being re-cut by the master tap; they had been faced only twice on the grindstone during the time, like an ordinary chasing tool of a screw-cutting lathe. The cost of the machine, for screwing bolts up to 1 inch diameter, was about £68. They had not yet tried cutting any but an angular thread, but he expected the machine would do as well for a square thread, if it were not too large for a single cut.

Mr. D. Joy inquired how many bolts would be screwed in a day by the machine, of $\frac{3}{4}$ inch diameter, and screwed for a length of $1\frac{1}{4}$ inch. He had known 500 made per day of $10\frac{1}{2}$ hours, with a common screwing machine, in which the dies were withdrawn for drawing back the bolt, when working as fast as possible. He asked, also, whether any diffi-

culty was experienced from stripping the thread in cutting, when the cutting was completed by running once up the screw.

Mr. Cunliffe replied, that he had never seen the thread stripped in any of the bolts, and the dies gave a clean cut like a chasing tool in a lathe, as shown by the specimens of bolts exhibited. The machine cut 92 screws per hour, or about 960 per day of 10½ hours, in screwing ¾ inch bolts through 1⅜ inch length.

ROYAL INSTITUTION OF GREAT BRITAIN.

Friday, May 2, 1862.

THE REV. JOHN BARLOW, M.A., F.R.S., VICE-PRESIDENT, IN THE CHAIR.

R. MONCKTON MILNES, Esq., M.P., "*On the International Exhibition for* 1862."

THE speaker stated that the managers of the Institution had arranged that some discourses should be there delivered, on the most important natural products to be exhibited at the Great International Festival, and had thought it advisable that these special addresses should be prefaced by a few considerations of the nature and scope of this wonderful congregation of the industries and intelligences of the world. He was much flattered at being selected to perform this duty, and could assure the members present that he should come into no competition with the eminent persons that would follow him, but should confine himself to those generalities and common-places, which are not always the more displeasing for being in some sort the reflection of their own minds.

It was the habit of this Society to deal rather with facts than speculations, and he would, therefore, direct their attention to the geographical and political conditions which alone rendered possible such an event as this. It had been written, with sufficient accuracy for verse, that—

"The total surface of this spherèd earth
  Is now surveyed by philosophic eyes;
Nor East nor West conceals a secret worth—
  In the wide ocean no Atlantis lies:
Nations and men, that would be great and wise,
  Thou knowest, can do no more than men have done;
No wond'rous impulse, no divine surprise,
  Can bring this planet nearer to the sun,—
  Civilization's prize no royal road has won."

The accessibility of the ocean-waters of the globe was a first necessity to this end, and this had been now accomplished from the ice-bound fires of Mount Erebus to the grave of Franklin. We could not say quite as much of our knowledge of the land of the world, but we perfectly understood the limits of our ignorance, and could fairly assume that there was no position of the earth yet unsurveyed which could in any notable degree add to our physical science, or extend our observation of the habits and destinies of mankind.

Although great continents are represented in our Exhibition only by

their fringes, we can hardly contemplate any such conversion of nature or man as should people the sandy spaces of Africa, the vast pastoral steppes of central Asia, or those huge fields of the unlimited liberty of animal and vegetable life which stretch in South America from the tropics to the polar snows, with the higher forms of industry, art, and civilization. It is enough that no longer can Tartar hordes swoop down on richer and fairer lands, and that the sage and saleratus prairies of North America cannot check the enterprising outgrowth of the Anglo-Saxon race.

And this brings us to another necessary condition of our Exhibition,—the security of the seas, and the general facility of commercial intercourse. The exceptional piracy which obstructs the trade of the waters of Oceania, and which the energy of Sir James Brooke has done much to repress, was once the custom of the world, and carried with it no notions of cruelty or disgrace. This evil was partially remedied by placing commerce under the safeguard of religion. Where the modern state establishes a factory or a free port, the old state built a temple. Thus the Tyrian Hercules linked together the trade of Greece and Phœnicia in a common worship: thus the fane of Jupiter Ammon was the great resting place and protection of the caravans of the desert: thus the lines of the chief Catholic pilgrimages were the paths not only of all travellers but of all merchants in the middle ages. The interchange of the gifts of God was sanctioned by Pagan and by Christian piety, and the notion of connecting trade with any inferiority of social station or intellectual power is a perverted remnant of the feudal system, where the jealousy between town and country tended to discredit labour and to idealize brute force.

The speaker proceeded to draw the distinction between ancient and modern trade. In the old Asiatic nations, where influence is still palpable among mankind on the score of authority and the bond of religion, the ideas of free trade and competition would have been incomprehensible. The exclusion of foreigners from the internal navigation of the several countries was universal, and none were permitted even to enter foreign ports, except with the *tessera hospitalis*, or some other symbol of a commercial treaty. Bars were thrown across the mouths of some rivers, as by the Persians across the Tigris, after their conquest of Babylon; traces of which impediments to navigation still remain; and in modern Europe the growth of liberal commerce has been slow indeed, and it is one of the happiest privileges of our time, that, as regards ourselves at least, we have come to see its consummation. In Sir Dudley North's "Discourse on Trade," published in 1691, the principle is laid down "that the whole world, as to trade, is but as one nation or people, and therein nations are as persons." But the Hollander and the Portuguese long remained the objects of a commercial animosity, which did not prevent the one from occupying our fisheries up to the very coast, and the other from sharing with us the dominion of India.

The social and political conditions represented by our Exhibition next occupied the attention of the speaker. The whole of this marvellous combination of energy and art is the result of free labour—of the spontaneous industry of mankind. It is not the mere application of local nature to local designs, but the collation and transmutation of

most diverse and distinct elements to the use and benefit of our race: the juxta-position of our coal and iron have suggested the manufactures of Sheffield, but it is the borax of Tuscany which assists the ingenious labourers of Colebrooke Dale. It is the sign and symbol of the general education of the world, which renders it impossible that discoveries can be neglected or arts be lost. The ignorance and superstition which kept mankind in unnecessary physical pain after the invention of the "*spongia somnifera*" of the twelfth century, can no longer check the anæsthetic powers of a beneficial nature, nor would it require a Harvey to revive, however he might be required to develop, the knowledge that perished with the ashes of Servetus.

But besides the intercommunication of nations in space, the speaker remarked, our Exhibition surely owes much to what he would call the trade of time, the thoughts, the feelings, the interests, that pass from generation to generation; the arts of Greece, the laws of Rome, the religion of the Semitic peoples,—the triple elements of modern civilization. The silent East gave the alphabetic character which has transmitted all the speeches and varied literature of the West; the Brahmin preserves the sacred language in which the linguistic science of modern times traces the mother-tongue of all the Indo-Germanic dialects that pass from mouth to mouth beneath these lofty domes.

The singularity of the circumstance that England should be the scene of this meeting of the nations was next alluded to. It was an illustration of the advantage of our insular position, which, being combined with sufficient territory, gave us at once the best political conditions of external power and domestic independence. Our greatest danger in history has been not our own conquest, but the conquest of France, which must have absorbed us into the continental system. Now, the peril of our power lay in the rapid political and moral elevation of the other European nations, but we could well afford to sacrifice some individual superiority to the common gain of mankind.

The speaker concluded with noting some of the probable effects of this great jubilee of commerce. Large congregations of men had always vividly struck the imagination, and the jubilee of Pope Boniface so occupied the mind of Dante, that he illustrates by it one of his supernatural pictures, and fixed it as the date of his spiritual journey. Such assemblies have always been looked on as harbingers of peace, and we know what were the expectations of 1851. But though that hope has proved delusive, we may yet feel thankful that, with the exception of the American calamity, all the disturbances of the world since that time have been the conflicts of a lower against a higher civilization, in which the higher has had the mastery. The materials here brought together must impress on the spectators the mutual dependence of nations, and the interests of amity. One of the chief objects of interest would be the various applications of art to industry; advantages perhaps somewhat balanced by the injury of the application of industry to art. As art becomes mechanical, it loses the spontaneous dignity which makes it most divine, and it seems impossible to diffuse and repeat it, without some diminution of its highest faculties. But this qualification does not extend to the relations between industry and science; there the moral is as certain as the material profit; intelligent labour is substituted for the mere exertion of brute strength; the supply of comforts

is extended from the luxurious classes even to the necessitous; the diseases consequent on physical hardship are diminished, and the average longevity of man increased. To the progress of scientific education not only the philosopher but the statesman looks for the diffusion of public happiness and the permanence of modern civilization. If the states that now rule the world are to escape the doom of Babylon and Rome, of Egypt and of Greece, it is in that they have not made their science the monopoly of a caste or a priesthood, but they have placed it more or less within the reach of the individual intelligence of the humblest citizen. Let the education that enables mankind to apprehend and value truth, proceed commensurately with the discoveries of science, and the community will gradually, but continuously, absorb into itself that knowledge which makes decay impossible, and our country may boldly and confidently meet whatever destiny remains for it in the inscrutable designs of the Creator and Ruler of the universe.

REVIVAL OF AN EXPIRED PATENT.

It is with considerable satisfaction that we are enabled to announce the passing of an Act of Parliament, which shows the disposition of the legislature to assist patentees whose patents have, by inadvertence, been lost through non-payment of the stamp duty due thereon. The credit of obtaining, in the nature of a private act, this proof of the sympathy of the legislature with patentees, when tripped up by the impolitic restrictions imposed by the patent law of 1852, is due to the energy and skill of Mr. Harrison Blair, of Manchester, to whose professional assistance we commend all patentees who may be similarly situated to his clients, Messrs. Webb and Craig. The following extracts will show both the grounds for the application, and the provisions of the Act:—

"Whereas the non-payment of the said stamp duty, and the non-production of the said Letters Patent, duly stamped, within the time limited for that purpose, arose from inadvertence on the part of the person employed by the said Thomas Webb and James Craig, to take the necessary steps for payment of the said duty, and production of the said Letters Patent; and it is expedient that the said Letters Patent should, notwithstanding, be rendered valid in manner hereinafter mentioned; but the purposes aforesaid cannot be effected without the authority of Parliament. Be it enacted:—

1. That within one month after the passing of this Act, it shall be lawful for the said Thomas Webb and James Craig, their executors, administrators, or assigns, to pay the said stamp duty of fifty pounds, and for the said Letters Patent (a true copy of which is set forth in the Schedule to this Act) or a duplicate thereof, to be stamped with proper stamps, showing the payment of the said stamp duty, and to be produced at the office of the said Commissioners, and for the said Commissioners of Patents, or their clerk, to stamp the said Letters Patent, or a duplicate thereof, specifying the date of such production, and to endorse on the said Letters Patent, or duplicate thereof, a certificate of the production of the same duly stamped, and to endorse

a like certificate upon the warrant for such Letters Patent filed in the said office.

2. That the said Letters Patent, so stamped as aforesaid, shall be considered, deemed, and taken to be, and to have been, as good, valid, and effectual, to all intents and purposes as if the said stamp duty of fifty pounds had been paid, and the said Letters Patent stamped with a proper stamp duty, and to that amount, had been produced by the said Thomas Webb and James Craig, at the office of the Commissioners of Patents for inventions before the expiration of three years fromthe date of the said Letters Patent, as in the said Letters Patent provided.

3. Provided always, that no action or suit shall be commenced or prosecuted at law or in equity, nor any damage recovered for or in respect of any infringements of the said Letters Patent, which shall have taken place after the expiration of the said three years from the date of the said Letters Patent, and before the payment of the said fifty pounds, and the stamping of the said Letters Patent in pursuance of this Act.

Scientific Adjudication.

ROLLS COURT, CHANCERY LANE.

May 26th, 27th, and 28th, 1862,

Before the Master of the Rolls and a Special Jury.

TOPHAM *v.* HARTSHORN.

THIS was an action for the alleged infringement, by the defendant, a Nottingham lace maker, of a patent granted to the plaintiffs, Messrs. Alfred, Joseph, and Jabez Topham, of St. Pierre-les-Calais, France, lace makers, for "improvements in the manufacture of lace," dated 15th July, 1861. As this is the first case on record of a patent suit having been tried before a jury by a judge in equity, special interest attaches to the proceedings, it being regarded as an important step towards an improved system of judicature; the practice hitherto having been to refer the case for trial to a common law judge, and then to deal with it in Chancery, according to the nature of the verdict given by the jury on its merits. Whether the course taken by the Master of the Rolls be adopted as a precedent, or from the difficulties consequent on patent trials, the labour shall have proved distasteful, the public must gain by the event; for in the one case more courts will be available for the settlement of this class of disputes, and serious delays will be avoided; and in the other, the now growing opinion that a special court for the trial of patent causes is required, will have received further confirmation.

The counsel for the plaintiffs were Mr. Bovill, Q.C., Mr. Baggaly, Q.C., Mr. Ffooks, and Mr. Aston, instructed by Messrs. Wilson, Bristow, and Carpmael; for the defendant, Mr. Follett, Q.C., Mr. Grove, Q.C., Mr. Hindmarch, Q.C., and Mr. Osborne, instructed by Messrs. Johnson and Weatheralls.

It appeared that the object of the invention was to manufacture lace with elongated inclined holes, in imitation of a certain kind of hand-

made lace, which was much worn in Paris. This the patentees accomplished by the introduction of "an extra thread or threads, which are caused to link in with bobbin threads, forming the sides where a hole is being produced, by which a bias or drag is induced towards the points where the extra threads are attached." The defendant did not attempt to deny the fact of having produced lace like the plaintiffs', but he denied the novelty of introducing drag threads into lace for any such purpose, and further contended that the result, if new, was rather a subject for registration than for a patent, as it referred solely to the production of a peculiar pattern of ground. The evidence adduced in support of the alleged infringement, and in answer to the complaint, will be found in substance in the following abridgement of the summing up:—

The Master of the Rolls.—Gentlemen of the Jury, there are three questions that you will have to determine in this case. The issues that are put to you are three:—First, you are to consider whether this is a new invention; in the next place you have to consider, if you determine that in the affirmative, whether it is sufficiently described upon the specification of the plaintiff, so that any person would be able to perform it at the expiration of the patent; and, thirdly, you have to consider whether there has been any breach of the invention.

Gentlemen, it is desirable, in the first place, to state to you what, in my opinion, is the principle upon which you should consider the evidence in this case. It is perfectly true that a mere application of a known instrument is no new invention; and, if a person—to use the illustration of one of the learned counsel—applies a hammer in a different mode to which it was previously applied, it is no new invention; but it may be that a hammer may be applied in conjunction with some other instrument, so as to produce a combination that had never been seen before, of great value, and of great importance, and that so stated, would be a new invention. It is important for you also to consider what it is that the plaintiff here professes to have invented. I do not mean to express any opinion to you whatever as to whether this is a new invention or not: that is for your consideration also. This is no new invention that he professes to have made in the machinery which is applied for lace making; but he applies a certain number of threads, which he calls "fugitive threads," for the reason that they can afterwards be removed from the fabric, for the purpose of producing a continued pressure, in the forming of the work, upon a particular hole made in the fabric; by which means, he says, any species of irregularity in the form of the hole can be produced; that this species of irregularity could not be produced before; that no person was able to apply this previously; and that the effect of the application of it is, to attain one of the great ends for which all imitation lace is made—a nearer approximation to hand lace.

Now the defendants take issue with him on that point:—They say that this was previously done. They do not mean to say, as far as I understand it, that this would not be a valuable thing to do, if it were now done for the first time, but that in fact, by the ordinary mode in which they have conducted the manufacture of lace, this has been previously done. As it appears to me, the issue between the two parties is very much of this character:—The plaintiff alleges that when the "drag" thread, as he calls it, is introduced into the fabric, when the hole is being made, it produces a continued pressure upon that part, so that the hole is made with a drag thread upon it, which causes that portion of the hole to retire. He says, that in all those instances where the defendant brings forward cases which he alleges to be similar, there is what is called a "lacing" thread used, and that the fabric is worked up to the lacing thread, and that the point of attachment is at or very near where the lacing thread is; and that the hole is not drawn out of its place by the other, but that by the ordinary mode of

working it up, it is worked up to the spot where the lacing thread connects itself with it; and that, if any drag is produced, that drag is of very small and imperceptible effect; but that, in the case of the plaintiff's patent, there is a long continued pressure, which gradually draws the hole out of its place; that it does that in various places; that by that means, by what he calls in the evidence "distortion," he produces figures of various varieties, which could not be produced before, and which more nearly resemble the hand-made or real lace. The defendant takes express issue upon that fact. He says that, in truth, all the holes which are made in the various specimens, which are produced, and which are expressly pointed to that purpose, are produced by the drag thread, which draws the hole out of its place, and not by the working up of the tissue to the place where the lacing thread connects itself with it. I think, gentlemen, that that is a very material point for your consideration with respect to the evidence; and having made these observations upon it, I will state shortly what I consider to be the evidence given on these points.

[The learned Judge then went through the evidence of the several witnesses in support of the plaintiff's and defendant's cases, the main points of which will be found in the following summary.]

The first witness called was Mr. James, who produced twenty-one specimens of lace, which were bought from the defendant, and the witnesses for the plaintiff said they were all of the plaintiff's manufacture. Upon cross-examination, in his opinion, "style" meant an alteration of patterns, and that a different style consists in the angularity of the holes. But this you must clearly understand—if you should be of opinion that this is only an alteration of a pattern, that is no subject for a patent. If it be a new and effectual mode by which all patterns can be made, whatever may be their character, of a different description, in a new mode, which never yet was discovered, and which applies to all patterns, then that would be a very different matter.

Mr. Cowper, the engineer, explains how, by pillows, you can make any manner of irregular shaped holes; that the holes in the old lace machines were all more or less round, and that the internal angles, in irregular forms, could not be produced by machinery as they could be by the hand. Then he explained the mode by which the hole was produced by the dragging of the threads, so that, in his opinion, any number of angles or irregularities may be produced in the hole, either in the shape of a clover leaf, or a heart, or anything of that description. He said, the function of the drag-thread was to pull out of shape, and that the lacing-thread was to detain the thing in its place, and that the drag-thread was distinct from the lacing-thread. He said, the specification was sufficient—that he had read the specification, and that he could easily complete the thing by that specification. He looks at two specimens, and says they could not have been done before the plaintiff's patent; and, referring to other specimens, he said they were done by "noosing," and not by a fugitive thread, and were not done by the plaintiff's process, but that, in point of fact, they were quite different from it.

Upon cross-examination, he says, that extra threads are always introduced from extra rollers. There was nothing new in the machinery, and there was nothing new in the extra thread, excepting the extra thread in this mode of applying it. There was nothing new in the motions of the machine: they were all regulated by the Jacquard. He said that all that was necessary in changing a pattern was, that extra threads should be introduced; that the beam should be properly weighted by weighting the roller, and altering the pattern of the Jacquard, and by that means you could always alter the pattern of any lace machine; but that this invention consists of an introduction of the drag-thread to distort the hole which is being formed. He says that, in his opinion, this was a novelty, by reason of the application of it. Then his attention was called to Croft's patent. He said, there were distending threads, and that the threads there kept the warps distended in the position in which they were placed, and prevented them from coming close together, but that they merely retain

them in their place, and do not draw aside the thread of the fabric as the plaintiff's does, and as they are specified in his patent. He then looked at z^1, z^5, and z^{5a} [specimens relied on by the defendant], and said positively, with respect to these, that they were not produced by the drawing down of the warp thread from any previous place, but that, in the course of the machine, it was worked down to that point.

Richard Hopcroft, a partner in a firm at Nottingham, agent for the plaintiff, and for twenty years a manufacturer of lace, says he received in September last a consignment of lace from the plaintiff; he saw it then for the first time, brought it to London, and showed it to buyers as a novelty; he received more orders than he could execute; but at the end of September the demand fell off, in consequence of similar goods appearing in the market at a lower price and of equally valuable quality. He then informed the plaintiff of the fact, and was instructed to obtain patterns from the defendant. He sent a warehouseman for that purpose, but he did not receive any. Then he looks at certain exhibits, upon which he makes comments, which are only to the effect of those previously stated.

John Sanderson Butler, a lace manufacturer at Nottingham, and brother-in-law to the plaintiff, looks at the various samples, and, among others, at z^5, and states that this could not have been drawn down to its place from a previous one by a drag thread, but must have been worked into that situation.

The plaintiff, Alfred Topham, is himself examined, and gives evidence to the same effect as the others.

The evidence of this witness closed the case for the plaintiff.

On behalf of the defendant, the first gentleman examined was Mr. William Brooks, who had been for twenty-five years acquainted with the lace manufacture. He stated, that to make the bobbinnet no Jacquard is required, but that, in every case, the Jacquard is required to give a pattern, and to give variety of pattern, that you can give every variety of pattern with the same instrument, and that it only requires to have the cards varied, in order to vary the pattern. Then two exhibits were produced to him, which are not very material —one is said to be hand-made and the other is machine-made. He did not seem clearly to understand, looking at them, which was which. Then he said, the specification appeared to him to be for taking a common lacing or drag thread to draw a hole into its proper place; every thread to draw the bobbinnet was an extra thread; it was used in a double sense—in one sense it was a drag thread, when it is woven into the pattern, but it is still an extra thread, when it is woven into the pattern, and afterwards taken away.

In Croft's patent of 1838, he was of opinion that it was exactly the same as the plaintiff's. There the distending thread and the drag thread are synonymous terms; I use them synonymously, and the object there is to pull out and keep distended the threads. He referred to page 34 in the patent, and said that, by the detached threads, the hexagonal hole was made, which might otherwise have been an ordinary mesh of the lace, or all pushed together, and that, keeping them distended in this manner was exactly the same process, in fact, as the plaintiff's patent. Upon cross-examination, he stated that he was the professional agent of the defendant. Some pillow lace was exhibited to him; he should say it was hand-made lace; he could not say it was not Croft's hexagonal lace. He says that Croft's patent and the plaintiff's patent are the same, except that the word "distention" is used in one, and "distortion" is applied in the other, to a spot, instead of being applied to a hole, but that, in substance, they are the same thing.

Cornelius Russell is next examined.—He is an important witness, because he made the fabric that has been very much commented on (z^5). Two of the plaintiff's witnesses say this could not have been produced by a drag thread. Cornelius Russell says, "I am a machine holder. I have been a lace designer and draughtsman for seventeen years, and have transferred patterns from hand lace to the Jacquard. We use extra warp threads for every pattern. Drag threads

were known before the publication of the plaintiff's patent. I used them. They only require attention to the holes of the cards. I have used drag threads to be removed and also to be retained, and I have done so to produce an alteration in the holes of the fabric, and to make angularity in those holes. z5 and z5a were both made by me in 1856. The red is what I call a drag thread. You will see the red on that plan B, presents the boundary of the hole, if there had been no drag thread; the action of the drag thread was a little above C. The line of the black A, was brought down to that point by the action of the Jacquard, and the two carriages." Gentlemen, that is the statement I have of his evidence, and it might be desirable that you should see that exhibit which is applicable to that subject.

The next witness examined was Mr. Henry William Nunn, who has been a manufacturer for forty-five years, at Newport, in the Isle of Wight. He produces exhibit z6: says he made that twenty years ago—from 1836 to 1846—that a thread is attached to the selvage, and that it is removed after it is made.

There is a little more difficulty with respect to this than some of the others, because, it appears, he made most of the patterns before the regular introduction of the Jacquard—at least before the introduction of the Jacquard as it is used at present. He then stated, "unless it had been introduced, it would have lain flat, and this drag thread distends it, and produces a purl inside it. On z21, which was made twenty years ago, the hole was drawn up in the same way as z6, and fastened to the selvage. With respect to z22, I made this twelve years ago; they are all made with drag threads, except by a lacing thread, to make a purl and take up a thread connected with the selvage of the next breadth of the lace."

Then Mr. Hartshorn, the defendant, was called, and he stated that "he had his patterns from a person who stated himself to be an agent in Calais. He sent them in a letter which was anonymous. I said, if he would give his name, I would correspond with him. He then sent several threads, and one of them was Topham's lace. I sent my agent to Paris, who brought back several real lace patterns, before I saw the plaintiff's patterns. I imitated them. I did not make them just the same until I got the plaintiff's lace with the threads in. I never wrote for lace with the threads in. In one piece the threads were left in; in the other two they were not. I imitated one of them. I imitated the hand-made lace. In his letter, he said, his name was "W. G.," but he did not want his name known at Nottingham, because he had left that town in debt. He said, if I would send him a sovereign a month, he would send me patterns regularly. He sent me patterns, and I paid him every month. This is the usual practice in the trade, particularly from France, whose style we follow. I did not know till he was here as a witness, that he was in the plaintiff's employment." He said, "I have sent patterns to France myself in a similar manner." In cross-examination, he says, that lace is not usually sold with the threads in, that this had the threads in; that he was unable to overcome the difficulty until he saw the piece with the threads in, and he managed to make it in the same way, and imitated one of Topham's patterns, it sold in the trade, and said it was Topham's lace, and may have said he would have sold it for a lower price. Three or four months ago he suspected that Healy was in the plaintiff's employment. He has received patterns from Calais, from various persons, but never paid any person in Calais before for taking patterns.

The learned Judge then referred to further evidence given by Mr. Benjamin Fothergill, Mr. Samuel Butler, lace manufacturer, at Nottingham, and Mr. William Selby, a designer, in support of the technical evidence given by defendant's witnesses and continued:—

Now, gentlemen, it is your province to determine whether the plaintiff's invention is, in fact, the application of a detached fugitive thread, which enables him, by that means, to drag the hole out of that place in which it would otherwise appear in the fabric, so as to produce a great number of varieties of forms, more immediately imitating the hand-made lace; or whether you consider that the lacing thread, by which a thread is kept in its place, can, as the defendant's witnesses

say, also perform the other function of drawing it out of its place, and producing all those various irregularities which seem to be essential to the making of lace very like the real hand-made lace. You are to consider whether that is a new invention, or whether that is stated already in Croft's process, which he describes, or by what the witnesses have described, and the exhibits which they have produced.

When you have come to a conclusion on that point, it is for you to consider whether there has been a sufficient statement in the specification. Upon that, I do not think you can have a great deal of difficulty; all the witnesses seem to understand very clearly what the specification describes. The only difference between them seems to be that they think it is a description of an old process, and not a description of a new one; but they do not express any doubt or difficulty in ascertaining what could be done with respect to it.

I think also, gentlemen, I must call your attention to this. It is not the mere fact of the removability of the drag thread which would constitute novelty. It is obvious, as one of the witnesses stated, that if, in addition to the performing the function that is required by the drag thread, it could be made a useful part of the fabric, as is occasionally done in the case of a lacing thread—that would be an improvement upon the invention, assuming it to be an invention; but the invention, if it be one, consists of merely introducing a thread, which solely performs the function of distorting the hole, and then, when it has distorted the hole, and the whole is formed and fixed, is removed when the fabric is taken away.

After you have considered that, you are to consider whether there has been (supposing this to be an invention) any breach of the plaintiff's patent or not. Upon that part of the case it is for you to take into consideration the evidence of Mr. James, and, in fact, the evidence of the defendant himself, to consider whether you can have any doubt that in fact he has used the particular process which the plaintiff professes to be a new invention, and for which he has taken out a patent. Those are the matters which you have to consider. The important point which you have to determine is, whether this is a new thing or not, whether it is a new thing of value which has been discovered by the plaintiff, which he is entitled to secure to himself by a patent.

Gentlemen, I think, with these observations, you will be enabled to come to a conclusion which will be satisfactory to yourselves, and perform the office of justice without further observations from me.

The jury, after consulting for two or three minutes, found a verdict for the plaintiff on all the issues.

Provisional Protections Granted.

1862.

[*Cases in which a Full Specification has been deposited.*]

1490. Nathan Ames, of Saugus, Massachusetts, U.S.A., for a new and useful self-feeding card printing press.—[*Dated May 16th.*]

1505. Edmund John Bridell, of the Middle Temple, for improvements in the manufacture of substances artificially colored, veined, or mottled, like marbles or other substances.—[*Dated May 17th.*]

1547. Augustus Bryant Childs, of New Oxford-street, for improvements in wringing machines,—being a communication.—[*Dated May 22nd.*]

1646. Joseph Betteley, of Liverpool, for improvements in ship building, and in rendering ships shot proof.—[*Dated May 31st.*]

1709. William Harding, of Aldersgate-street, for improvements in the manufacture of bonnet fronts, and in apparatus to be employed therein.

1712. George Haseltine, of Fleet-street, for a new and improved photographic camera,—being a communication.

The above bear date June 7th.

[*Cases in which a Provisional Specification has been deposited.*]

334. John Adams Knight, of Symond's-inn, for improvements in washing machines,—being a communication. —[*Dated February 8th.*]

465. Robert Pickin and William Edwin Pickin, both of Birmingham, for improvements in the manufacture of carriage bodies.—[*Dated February 21st.*]

508. Charles William Heckethorn, of St. Ann's-road, Brixton, for improvements in obtaining and applying motive power by means of a wheel containing mercury.—[*Dated February 25th.*]

611. John Carpendale and Thomas Middleton, both of Sheffield, for improvements in means of producing raised chasing on copper, silver, and Britannia metal, by the application of pressure.—[*Dated March 7th.*]

843. John Haworth, of Southampton-street, Bloomsbury, for an improved method of conveying telegraphic messages and signals by means of electricity, without the intervention of any continuous artificial conductor.

849. William Frederick Henson, of New Cavendish-street, Portland-place, and Henry Henson Henson, of Parliament-street, for improvements in wicks for candles and lamps.

The above bear date March 27th.

921. Herrmann Lorenz and Theodor Vette, both of Berlin, for improvements in filters.—[*Dated April 1st.*]

934. William Clark, of Chancery-lane, for an improved apparatus for manifold writing,—being a communication.—[*Dated April 2nd.*]

947. Joseph Lee, of Lincoln, for improvements in traction engines, and boilers for traction, locomotive, and other purposes.—[*Dated April 3rd.*]

985. George Haseltine, of Fleet-street, for improvements in lamps, especially designed for burning hydro-carbon oils,—being a communication.

989. James Carrington, of Queen's-gate-mews, Kensington, for improvements in the form of bricks, and in the arrangement thereof for paving stables and stable yards.

The above bear date April 7th.

993. Hugo Levinstein, of Pinners-court, Old Broad-street, for improvements in lustreing silk, and in machinery or apparatus employed therein.

1001. Howard Ashton Holden, of Birmingham, and Charles Weekes, of Carmarthen, for improvements in apparatus used in drawing water or other fluids from cisterns, tanks, or other vessels.

The above bear date April 8th.

1013. Josiah Jones, jun., of Liverpool, for improvements in constructing and arming ships and vessels.—[*Dated April 9th.*]

1041. Edward Hamer Carbutt, of Bradford, Yorkshire, for improvements in pistons.—[*Dated April 11th.*]

1084. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the manufacture of blasting powder,—being a communication.—[*Dated April 15th.*]

1110. John Henry Johnson, of Lincoln's-inn-fields, for improvements in machinery or apparatus for cutting the teeth of wheels, racks, or segments,—being a communication.

1111. John Ashbury, of Manchester, for improvements in the permanent way of railways.

1112. John Henry Johnson, of Lincoln's-inn-fields, for improvements in railway and common road carriages, —being a communication.

1113. John William Ford, of Shooter's-hill, Kent, for improvements in sewing maehines,—being a communication.

1114. John Weston, of Upper White-cross-street, for improvements in machinery for morticing, drilling, and dove-tailing, and in tools to be used therewith.

The above bear date April 16th.

1115. Charles Denton Abel, of Southampton-buildings, for improvements in the manufacture and production

of the chromates and the bichromates of potash and of soda,—being a communication.

1116. Alfred Krupp, of Essen, Prussia, for certain improvements in the manufacture of screw propellers.

1117. Victor Fleury, of Paris, for improvements in clocks and other time-keepers.

1118. William Hodgson Hutchinson, of Bury, Lancashire, for improvements in the manufacture of ammonia or its salts, and cyanogen or its compounds, from refuse gluten.

1119. John Griffiths, of Liverpool, for improvements in propelling ships and other navigable vessels.

1120. William Harling, John Matthew Todd, and Thomas Harling, all of Burnley, Lancashire, for improvements in looms for weaving.

1121. Frederick Tolhausen, of Paris, for an improved machine for making bricks, tiles, and the like articles,—being a communication.

1122. James Murphy, sen., of Glasgow, for improvements in looms.

1123. John Pugh Temperley, of Bolton-le-Moors, Lancashire, for improvements in the air pumps of steam engines.

1125. Jean Louis Perin, of Paris, for improvements in machinery for mortising wood.

1126. Henry Gardner, of Leeds, for improvements in machinery for breaking and preparing flax and other fibrous substances.

1127. Charles Denton Abel, of Southampton-buildings, for improvements in the manufacture and production of certain alloys containing cadmium, —being a communication.

1128. Richard Archibald Brooman, of Fleet-street, for improvements in taps and valves,—being a communication.

1129. Richard Archibald Brooman, of Fleet-street, for improvements in buffing apparatuses and in draw springs,—being a communication.

1130. William Anderson, of Shaftesbury-street, for improvements in tubular steam generators.

1133. William Clark, of Chancery-lane, for improvements in the manufacture of railway rails,—being a communication.

1134. Joseph Cedric Rivett, of Farnworth, Lancashire, and John Muir Hetherington, of Manchester, for improvements in machinery or apparatus for preparing cotton and other fibrous materials for spinning.

1135. Ralph Wedgwood, of Barnes, Surrey, for improved apparatus for facilitating the saving of life in cases of fire.

The above bear date April 17th.

1136. Robert Dennison, of Lancaster, for improvements in reaping and mowing machines.

1137. Edwin Dove, of Hunter-street, for improvements in matches and fuzees, and apparatus for containing and igniting the same.

1138. Joseph Scott Phillips, of College-crescent, Finchley-road, for a new method and apparatus for the propulsion of vessels through the water.

1139. John Shanks, of Barrhead, Renfrewshire, N.B., for improvements in apparatus for promoting ventilation, also applicable to drying stoves.

1140. Moses Masters, of New Kent-road, for improvements in artificial legs.

1141. Richard Stuart, Graham Stuart, and Henry Hill, all of Sheffield, for improvements in fastening flyers upon spindles.

1142. Benjamin Rhodes, of Old Ford-road, Bow, for improvements in the machinery for, and in the method of making, as also in the materials to be employed in the manufacture of, cylinders, tubes, and other vessels, from paper and other materials or fabrics.

1143. Walter Munn and David Ballantine, junior, both of Borrowstounness, Linlithgow, for improvements in mills for grinding.

1144. Benjamin Browne, of King William-street, for improvements in breech-loading fire-arms,—being a communication.

1145. Edward Loysel, of Cannon-street, for improvements in locks and fastenings.

1146. William Rose, of Hales Owen, Worcestershire, for improvements in the manufacture of tubes, more especially applicable to the barrels of fire-arms and ordnance.

1147. Alexander Parkes, of Birmingham, for improvements in the manufacture of rollers for surface printing and embossing.

1148. Alfred Nicholson Wornum, of Store-street, for improvements in pianofortes.

1149. Alexander Parkes, of Birmingham, for improvements in surface condensers.

1150. Henry Lumley, of Chancery-lane, for an improved rudder.

The above bear date April 19th.

1152. James Combe, of Belfast, for improvements in machinery for hackling flax and other fibrous substances.

1154. John Pickard and Thomas Morris, both of Preston, Lancashire, for improvements in furnaces for the prevention or consumption of smoke.

1156. Sandiforth Featherstone Griffin, of New Adelphi-chambers, for improvements in the construction of vessels of war and batteries on land.

1157. Abraham Marks, of Cannon-street-road, for improvements in artificial feathers; applicable to certain ornaments of dress.

1158. Edwin Francis Clarke, of Waterloo, near Liverpool, for improvements in propellers for steam ships and other vessels.

1159. Richard Archibald Brooman, of Fleet-street, for improvements in jackets or protectors for covering metal and other surfaces, to prevent loss of heat by radiation,—being a communication.

1160. Frederick Tolhausen, of Paris, for an improvement in horse shoes, —being a communication.

1161. Thomas Attwood, of Lewes, Sussex, for improvements in kitcheners.

1162. Charles Callebaut, of Paris, for some improvements in sewing machines.

1163. Adam Dixon, of Birmingham, for improvements in knife and fork cleaning machines.

1164. James Chapman Amos, of the Grove, Southwark, for an improved mode of, and improvements in apparatus for, supplying surface condensers with water; part of which improvements is applicable to blowers and rotary pumps generally.

1165. Christopher Crabb Creeke, of Bournemouth, for improvements in the construction of drain and other pipes.

The above bear date April 21st.

1166. Thomas Lea and Samuel Smith, both of Smethwick, for improvements in burglary alarms or indicators.

1168. Silas Safford Putman, of Dorchester, Norfolk County, Massachusetts, U.S.A., for certain improvements in machines for forging horse-shoe nails and other articles.

1169. Charles Earp Elliott, of Aldermanbury-postern, for improvements in the preparation of dried yeast,—being a communication.

1170. Charles Webster, of Radford, Nottingham, for improvements in self-acting fountains, adapted for garden engines, fire engines, and for raising and forcing water from mines, wells, and other places.

1171. Arthur Warner, of Threadneedle-street, for improvements in the construction of vessels of war, and in floating or other batteries.

1172. John Henry Johnson, of Lincoln's-inn-fields, for improvements in apparatus for propelling and manœuvring ships,—being a communication.

1173. George Scoville, of Wood's Hotel, Furnival's-inn, for improvements in pistons for steam engines,—being a communication.

1174. Robert Boby, of Bury St. Edmunds, for improvements in the construction of apparatus for rolling or crushing land.

The above bear date April 22nd.

1175. Richard Jinks, of Upper King-street, Bloomsbury, for improvements in apparatus for suspending, raising, and lowering Venetian blinds, and for retaining them and other blinds, and also curtains and sunshades, at any required heighth.

1176. Luke Holden, of Burnley, Lancashire, for certain improvements in harness for animals of draught and burden.

1177. William Moir, of Manchester, for an improved instrument for ascertaining the specific gravity of liquids.

1178. George Norton Bates, of New Basford, Nottinghamshire, for improvements in dressing lace and other fabrics.
1179. George Henry Birkbeck, of Southampton-buildings, for improvements in lubricating apparatus,—being a communication.
1180. William Carpenter, of Greenwich, for an improved method of printing in colors.
1181. James Price, of Dundalk, Ireland, for improvements in spikes for railways and other purposes, and in the mode of manufacturing and securing the same.
1182. Alexander Robertson, of Dublin, and Richard Barter, of Blarney, Cork, for improvements in apparatus for distributing and projecting fluids, either for surgical, sanatory, or domestic purposes.
1183. William Fear, junior, of Bristol, for improved arrangements for joining the saw plates of veneer and other saws constructed in segments.
1185. John Henry Johnson, of Lincoln's-inn-fields, for improvements in apparatus for taking deep sea soundings, and for recording the speed of ships,—being a communication.
1186. George Tomlinson Bousfield, of Loughborough-park, Brixton, for improvements in the construction of elliptic springs for wheel carriages, and other purposes,—being a communication.
1187. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improvements in looms for manufacturing tufted pile fabrics, and in the mode of operating such looms,—being a communication.
1188. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for an improved fertilizing composition,—being a communication.
1189. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the manufacture of imitation lace, net, or open-work fabrics,—being a communication.
1190. Charles Edwin Heinke, of Great Portland-street, for improvements in diving helmets, dresses, and apparatus; parts of which improvements may also be employed for extinguishing fires in ships and other confined places.

The above bear date April 23rd.

1191. John Endean, of Locksfields, Walworth, for improvements in cocks, taps, and valves.
1192. William Haggett, of Sherborne, Dorsetshire, for improvements in locomotive engines and carriages for railways; part of which improvements are applicable to carriages and vehicles for tram and common roads.
1193. Henry Wheatley, of Hopton Mills, Mirfield, Yorkshire, for improvements in or applicable to the employment of steam for heating or drying purposes.
1194. John Bond, of Burnley, Lancashire, for certain improvements in projectiles; which improvements are applicable to horns attached to vessels for war purposes.
1195. William Denny Ruck, of Duke-street, London-bridge, for the manufacture of grease from coal tar, coal oil, creosote, or dead oil.
1196. John Winsborrow, of Samson-terrace, Marlborough-road, Dalston, for improvements in wet gas meters.
1197. George Davies, of Seven Sisters-road, Holloway, for improvements in the manufacture of matting, and in apparatus for the same.
1198. Joseph Adolphe Traversier, of Paris, for some improvements in making ladies' bonnets.
1199. John Franklin Allen, of New York, for improvements in slide valves and valve gear for steam engines.
1200. George Washington Belding, of King-street, Cheapside, for improvements in harrows or cultivators,—being a communication.
1201. Frederick Dangerfield of Bedford-street, Westminster, for improvements in lithographic or zincographic presses.
1202. Robert Mushet, of Coleford, for an improvement or improvements in the lining, repairing, or "fettling" of puddling furnaces.
1203. Joseph Offord, of Wells-street, Oxford-street, for improvements in carriages.
1204. Rudolf Zimara, of St. Petersburg,

for improvements in stoves for heating and ventilating buildings.

The above bear date April 24th.

1206. Silas Covell Salisbury, of Coventry, for improvements in the construction of sewing machines.
1207. Frederick Barnett, of Paris, for improved electric danger signals for railways and other cognate purposes.
1208. George Richards, of Caroline-street, Bedford-square, for improvements in ordnance and the manner of loading such with the charges and projectiles suitable thereto.
1209. John Francis Brunet, of King William-street, Strand, for improvements in the manufacture of fringes, and in apparatus connected therewith,—being a communication.
1210. Richard Christopher Mansell, of Ashford, for improvements in the construction of wheels to be used on railways.
1211. Peter Robert Drummond, of Perth, N.B., for a revolving rake for lifting objects from the ground.
1213. Richard Percy Roberts, of Exeter-villas, Kennington-oval, for improvements in the préparation of paper for copying letters and other documents, and in the preparation of copying ink.
1214. John Elder, of Glasgow, for improvements in steam engines and boilers.
1215. John Shaw, of Liverpool, for improvements in steam and other power engines and indicators,—being a communication.
1216. James Aspinall, of Middlesborough-on-Tees, for an improved apparatus for the safe conveyance from sea to land of ships' papers, documents, money, and other valuables, when wrecks or other casualties occur at sea.
1217. Charles Reed, of Kintbury, Berks, for a new method of treating the *Sorghum saccharatum* or *Holcus saccharatus*, in order to obtain saccharine liquor and pulp therefrom.
1218. Alexander Carnegie Kirk, of Bathgate, N.B., for improvements in refrigerating apparatus.
1219. Augustus Applegath, of Dartford, for improvements in printing in colours, and in apparatus to be employed for this purpose.
1220. William Hale, of John-street, Adelphi, for improvements in rockets.
1221. William Fisken, of Stamfordham, Northumberland, for improved apparatus for cultivating land by means of steam power.
1222. Lachlan McLachlan, of Manchester, for improvements in governing or regulating light used for taking photographic portraits and other photographic pictures; part of which improvements is also applicable to lighting picture galleries.
1223. Enrico Angelo Ludovico Negretti and Joseph Warren Zambra, both of Hatton-garden, for improvements in the construction of mercurial minimum thermometers.
1224. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in chimneys for lamps,—being a communication.

The above bear date April 25th.

1225. Dudley Charles Le Souëff, of Twickenham, for an improvement in the manufacture of nails, bolts, rivets, screws, eyes, and split keys or pins, —being a communication.
1227. George Henry Law, of Rochester-road, Camden New Town, for improved means for draining flower pots and other articles or things which require draining in the same or a similar manner.
1228. John Gay Newton Alleyne, of Alfreton, Derbyshire, for improvements in machinery and apparatus for the preparation and manufacture of iron and steel.
1229. Emile Alcan, of Coleman-street-buildings, for an improvement in, or addition to, carding engines,—being a communication.
1230. William Clark, of Chancery-lane, for improvements in collars, wristbands, and cuffs,—being a communication.
1231. Squier Cheavin and George Cheavin, both of Boston, Lincolnshire, for improvements in filtering and purifying water, and in apparatus employed therein.
1232. Francis Gybbon Spilsbury and Frederick William Emerson, both of Stratford, Essex, for improvements

in the treatment of fusel oil, and for various applications of the same to useful purposes.

1233. Arthur Boyle and Thomas Warwick, both of Birmingham, for new or improved machinery for manufacturing hair pins and cottar pins; a part of which machinery may also be used for cutting off and pointing wires for various purposes.

1234. Herbert William Hart, of Manchester, for improvements in the manufacture of reflectors and shades for gas and other lights.

1235. Gustav Bischof, junior, of Swansea, for improvements in treating solutions containing copper and silver, or either of them, to obtain metallic copper and silver.

1236. George Hedgcombe Smith, of North Perrott, Somersetshire, for improvements in the manufacture of crinoline or elastic hoops for dresses.

1237. Aaron Lester, of Coventry, for improvements in the manufacture of the fronts or uppers of slippers, shoes, boots, and gaiters, and of mats, bags, fire screens, and various other articles which are usually made of ornamental or Berlin needlework.

1238. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the manufacture of hollow glass ware,—being a communication.

1239. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improvements in lamps for burning coal-oil and other hydro-carbons, being a communication.

The above bear date April 26th.

1240. George Barry Goodman, of Baker-street, Portman-square, for improvements in machinery or apparatus for preventing accidents in or at mine shafts.

1241. John Burnie, of Castle Douglas, Kirkcudbright, N.B., for improvements in tobacco pipes.

1242. John Fletcher, of Farnham-place, Southwark, for improvements in the apparatuses for treating saccharine liquids.

1243. Robert Vaile, of Auckland, New Zealand, for improvements in propellers for ships and boats.

The above bear date April 28th.

1245. George Robert Samson, of Old Chapel-row, Kentish-town, for improvements in valves or cylinders for wind musical instruments.

1246. Henry Fox Wells, of Woolwich, for improvements in screw clamps or cramps for joiners' and other work.

1247. John William Caley and Frederick Goodman Caley, both of New Windsor, for an improved textile fabric.

1248. James Eglinton Anderson Gwynne, of Essex-street-wharves, Strand, for improvements in the construction of centrifugal pumps, and in the application thereof; parts of which improvements are also applicable to other pumps.

1250. Samuel Wilmott Newington, of Goudhurst, Kent, for improved apparatus for letting off and stopping the flow of liquids from casks and vessels; such apparatus forming a tap, and substitute for the ordinary vent peg.

1251. Edwin Clark, of Great George-street, Westminster, for improvements in arches,—being a communication.

1252. William Clark, of Chancery-lane, for an improved method of preserving animal and vegetable substances,—being a communication.

1253. John Ross, of Brompton, for improvements in grinding stones, or surfaces for grinding grain and other substances,—being a communication.

1254. Richard Bright, of Bruton-street, Westminster, for improvements in lamps, and in apparatuses for lighting argand and other wicked lamps.

1255. John Cliff, of the Imperial Potteries, Lambeth, for improvements in insulators for supporting telegraph wires.

1256. William Littell Tizard, of Mark-lane, for improvements in heating, cooling, and condensing apparatuses.

1257. David Monroe Childs, of New Oxford-street, for improvements in steam engines,—being a communication.

1258. David Monroe Childs, of New Oxford-street, for improvements in reaping and mowing machines,—being a communication.

1259. David Monroe Childs, of New Oxford-street, for improvements in the means of changing a rotary into a reciprocating and a reciprocating into a rotary movement in machinery,—being a communication.

1260. Edward Brown Wilson, of Parliament-street, Westminster, for an improvement in the machinery or apparatus used in the manufacture of malleable iron and steel.

1261. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in machinery for picking, burring, and cleaning wool and other fibrous substances,—being a communication.

1262. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the construction of mowing and reaping machines,—being a communication.

1263. Michael Henry, of Fleet-street, for improvements in apparatus for aerating liquids, and in fastenings for the said apparatus, and for other articles,—being a communication.

The above bear date April 29th.

1264. Edward Moore, of Tewkesbury, for improvements in the manufacture of dress shirts and dresses.

1265. Alfred Travis and Benjamin Travis, both of Dukinfield, for improvements in engines for carding cotton and other fibrous materials.

1266. Arthur Irwin Mahon, of Rathmines, Dublin, for improvements in projectiles.

1267. John Harrington and Thomas Perkins, both of Birmingham, for an improvement or improvements in mounting photographic portraits for visiting cards, and in mounting photographs in general.

1268. George Davies, of Serle-street, for an improved electric apparatus, applicable to various useful purposes,—being a communication.

1269. George Davies, of Serle-street, for improvements in the manufacture of nails, screws, and other analogous articles in malleable cast iron,—being a communication.

1270. Achille Tranquille Mercier, of Louviers, France, for improvements in weaving looms.

1271. James Maiden, of Waterloo, near Ashton-under-Lyne, for improvements in safety lamps.

1272. Evan Leigh, of Manchester, for improvements in the construction of ships and floating batteries, in mounting their guns, and in the application of steam power; parts of which improvements are also applicable to land batteries and forts.

1273. Thomas Piatti, of Paris, for improvements in the propulsion of ships and other vessels, and in the means and apparatus employed for this purpose.

1274. Henry Hickman, of Miller-place, Park-road, Dalston, for an improvement in the method of fastening ladies' crinoline skirts and other articles of wearing apparel, and elastic and other bands.

1275. James Oxley, of Sheffield, for improvements in apparatus for cutting and chopping bread and other substances.

1276. George Henry Birkbeck, of Southampton-buildings, for improvements in the construction of couches or settees, for the purpose of sitting, lying, or reclining upon,—being a communication.

1277. John Money Carter, of Monmouth, for improvements in harness and the shafts of carriages.

1279. Werner Staufen, of George-street, Portman-square, for a new material to be used in the manufacture of brushes, and also applicable to the purposes for which bristles, horse hair, and human hair are now used.

1280. James Lee Norton, of Belle Sauvage-yard, Ludgate-hill, for improvements in apparatus for drying fibrous materials and yarns.

1281. James Murdoch Napier, of the York-road, Lambeth, for improvements in machinery for manufacturing projectiles.

1283. Henry Fowler Broadwood, of Great Pulteney-street, for improvements in the construction of pianofortes.

1284. Henry Willis, of Albany-street, Regent's Park, for improvements in valves for the supply and discharge of gaseous bodies.

1285. William Edward Newton, of the Office for Patents, 66 Chancery-lane,

for improvements in lamps,—being a communication.

1286. William Thomas Loy, of Rood-lane, City, for improved machinery or apparatus for carding cotton and other fibrous substances of a similar character,—being a communication.

The above bear date April 30th.

1287. James Swallow and James Allinson, both of Heckmondwike, Yorkshire, for improvements in the manufacture of carpet fabric.

1288. William Beckford Smith, of Camborne, Cornwall, and William Bennetts, of Tucking Mill, Cornwall, for improvements in the method of, and apparatus for, preventing the injurious effects occasioned by smoke, sulphur, and the deleterious gases which escape from stacks, chimneys, calcining houses, chemical and other furnaces.

1289. Charles Pierre Alexandre Douchain, of St. Cloud, France, for improvements in apparatus for letting in or shutting off water or other liquids.

1290. Thomas Holmes, of Princess-terrace, Regent's-park, for an improvement in the manufacture of military cartouches, porte-monnaies, courier bags, letter bags, knapsacks, and other articles of a like nature.

The above bear date May 1st.

1291. William Huntington and Thomas Huntington, both of Liverpool, for improvements in the machinery for the manufacture of bread.

1292. Hermann Kohn, of Berlin, for a new method of making any kind of stuffs, textures, or fabrics waterproof.

1293. William Bodden and William Mercer, both of Oldham, for improvements in certain parts of machinery for slubbing and roving cotton and other fibrous substances.

1294. Thomas Foxall Griffiths, of Birmingham, for an improvement or improvements in raising or shaping sheet iron.

1295. Robert Walker, of Glasgow, for improvements in malting, and in apparatus therefor.

1296. Ormrod Coffeen Evans, of Church-street, Old Kent-road, for a reversible attachment to a shaft or arbor, for converting reciprocating rectilinear into rotary motion.

1297. Ormrod Coffeen Evans, of Church-street, Old Kent-road, for an abdominal truss, intended for the more perfect support and cure of hernia.

1298. Charles Ashwell, of Albany-road, Barnsbury-park, for an improved safety fastening, applicable to the locks of doors.

1299. Richard Archibald Brooman, of Fleet-street, for improvements in apparatus for superheating steam,—being a communication.

1301. Matthew Paul, of Dumbarton, for improvements in windlasses and capstans, or ships' winding apparatus.

1302. James Waller Gill, of Crediton, Devonshire, for improved apparatus for turning up and pulverizing the soil of land for cultivation.

1303. Henry Welch, of Millwall, for improvements in securing or attaching armour plates on or to ships or vessels.

1304. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improved electrical apparatus, applicable to the lighting of gas,—being a communication.

The above bear date May 2nd.

1305. William Mossman, of Cleveland-terrace, Islington, for improvements in the manufacture of bonnets, hats, or coverings for the head.

1306. Joseph Brierley, of Blackburn, for improvements in the construction of fire plugs or valves to be used in extinguishing fires, or for other purposes where water is required to be drawn from mains under pressure.

1309. Edward Ormerod and Christian Schiele, both of Manchester, for improvements in machinery or apparatus for cutting or dressing stones; which improvements are also applicable for hammering, crushing, or otherwise reducing metals and other materials.

1310. Henry George Moffatt, of Dalston, for an improved advertising medium.

1311. Jean Marie Herdevin and Joseph Alexandre Jullien, of Paris, for improvements in sluice cocks.

1312. Thomas Snowdon, of Stockton-on-Tees, for improvements in the manufacture of steel tyres, hoops, and cylinders, and in furnaces employed therein, and applicable to the melting of steel generally,—being a communication.

1313. John Mortimer Heppel, of Great George-street, Westminster, for improvements in the construction of the permanent way of railways.

1314. John Herdman, of Belfast, for improvements in the manufacture of wrought iron, steel, or combined wrought iron and steel plates, adapted for ship building and other purposes for which strength and lightness are required.

1315. William Black, of Northampton, for improvements in lottery and ballot boxes.

1317. Michael Henry, of Fleet-street, for improvements in the process of, and apparatus for, preparing materials for the manufacture of paper, and in obtaining products from agents used in the said process; part of the invention being also applicable to apparatus for washing, —being a communication.

1318. John Fowler, of Leeds, for improvements in engines for hauling agricultural implements.

1319. Salvatore Merolla, of Naples, for improvements in fire-arms.

1320. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for an improved method of joining boxes,—being a communication.

1321. James Mellodew and Thomas Mellodew, both of Oldham, and Charles William Kesselmeyer, of Manchester, for improvements in looms for weaving.

1322. Charles Schlickeysen, of Berlin, for improvements in machinery for moulding bricks, tiles, pipes, and turf.

1323. John Heyworth, of Shawforth, near Rochdale, for improvements in looms for weaving.

1324. Pierre Victrice Lefebre, of Paris, for improvements in fountain pens.

The above bear date May 3rd.

1325. Alfred Williams, of New Windsor, Berkshire, for the construction of a backed form or seat, capable of being converted into a level table with seat or a desk, either level or sloping, or at any angle.

1326. Thomas Parkinson, John Norman, and Richard Cottam, all of Blackburn, for certain improvements in the construction of furnaces for steam boilers.

1327. Louis Guillaume Perreaux, of Paris, for certain improvements in clocks or machines for keeping time.

1328. Herbert Allman, of Bedford-row, for certain improvements in the construction of locks.

1330. Samson Barnett, of Forston-street, Hoxton, for improvements in helmets for divers.

1331. Thomas Francis Richard Brindley, of Leonard-square, Finsbury, for improvements in travelling and other flasks, decanters, bottles, and other necked vessels.

1332. Christopher Binks, of Parliament-street, for improved methods of obtaining hydrogen gas and certain gaseous compounds of hydrogen and of carbon.

1334. Joseph Victor, of Wadebridge, Cornwall, James Polglase, of Bodmin, and William Rounsevell, of St. Breock, near Wadebridge, for improvements in the manufacture of safety fuses for mining and other purposes.

1335. Robert Burley, of Glasgow, for improved arrangements for using ordnance under water, and in part applicable otherwise.

1336. Robert Bushby, of Little Hampton, Sussex, for an improved method of lifting or lightening ships for entering shallow harbours or docking, and other purposes.

1337. James Roscoe, of Leicester, for an improved lubricator for steam engines.

1338. Pierre Léon Auguste Théophile Sourbé, of Condom, France, for an improved method of maturing spirits and wines.

1339. Edward Brown Wilson, of Parliament-street, Westminster, for an improvement in the machinery or apparatus used in the manufacture of malleable iron and steel.

1340. John Henry Johnson, of Lincoln's-inn-fields, for improvements in steam generators,—being a communication.

1341. John Adcock, of Marlborough-road, Dalston, for improved apparatus for measuring and indicating distances travelled by wheel carriages.

1342. Benjamin Cooke, of Devonport, for an improved construction of implement for cutting turf.

The above bear date May 5th.

1343. Thomas Cabourg, of Paris, for improvements in machines for the purpose of uniting together, by means of screws, leather used in the manufacture of boots and shoes, and other articles composed of two or more pieces of leather.

1344. Richard Mills, of Bury, Lancashire, for improvements in washing, wringing, drying, and mangling machines.

1345. Augustin Morel, of Roubaix, France, for improvements in heckling machines.

1346. George Borthwick, of Bedford, Lancashire, for certain improvements in the constructions of ships, boats, and rafts.

1347. Paul Chenaillier, of Paris, for improvements in apparatus for concentrating liquids, or for condensing alcoholic or other vapours.

1348. John Clarke and John Richmond, both of Chilvers Coton, Warwickshire, for improvements in looms for weaving.

1349. Walter Richard and John Richard, both of Edinburgh, for improvements in the manufacture of printing types, spaces, and quadrats.

1350. John Henry Johnson, of Lincoln's-inn-fields, for improvements in the manufacture and production of minium or red lead,—being a communication.

1351. William Greaves, of Portland-street, Soho, for improvements in safety stirrup bars.

1352. John Henry Johnson, of Lincoln's-inn-fields, for improvements in the manufacture of soda and potash, and of their carbonates,—being a communication.

1353. William Clark, of Chancery-lane, for an improved buckle or fastening,—being a communication.

1354. William Clark, of Chancery-lane, for improvements in cylinder printing apparatus,—being a communication.

1355. James Edward Ransome, William Copping, and Lawson Lansdell, all of Ipswich, for improvements in harrows.

The above bear date May 6th.

1356. William Edward Nethersole, of Swansea, for improvements in parts of railway trucks and waggons; parts of which are applicable to railway carriages.

1358. Eugène Bourdon, of Paris, for improvements in the construction of blowing fans; which improvements are also applicable to centrifugal pumps for raising water and other liquids or gases, or for exhausting the same.

1359. Charles Victor Fournier de Berville, of Paris, for an improved safety coupling bar for locomotives and other railway carriages.

1360. Philip Howard Colomb, of Devonport Dockyard, for improvements in arrangements and apparatus for signalling.

1361. Thomas Markland, of Hyde, Cheshire, for certain improvements in wearing apparel.

1362. Thomas Henry Hopwood, of Hulme, Manchester, for certain improvements in the means or apparatus to be employed for the purpose of raising sunken vessels or other submerged bodies, and also in the application of a self-acting balance and regulator to the pontoons used therein.

1363. Charles Clark, of the City-road, for an improved cigar tube.

1364. Nicholas Wood, of Hetton-hall, Durham, and Joseph Stockley, of Newcastle-on-Tyne, for improvements in apparatus for grinding, smoothing, and polishing plate glass.

1365. Jeremiah Johnson and Arthur Chapman, both of Leatherhead, Surrey, for improvements in apparatus for preventing collisions on railways.

1366. Richard Archibald Brooman, of Fleet-street, for an improved box and apparatus for containing and igniting matches,—being a communication.

1367. Richard Archibald Brooman, of

Fleet-street, for improvements in swings,—being a communication.

1368. John Combe, of Leeds, for an improved machine for spreading and drawing into slivers flax, hemp, jute, and other fibrous substances.

1369. George Tomlinson Bousfield, of Loughborough-park, Brixton, for improvements in applying steam power to tilling land by means of a digging locomotive,—being a communication.

1370. Joseph Haley, of Rochester-villa, Battersea, for improvements in armour plates for ships, boats, and batteries.

1371. William Gossage, of Widnes, for certain improved apparatus to be used in the manufacture of soap.

1372. Désiré Marchal and Adrien Carton de Wiart, both of Brussels, for an improved method of preventing the destructive effects of vibration or jar on the permanent way of railways, and on the wheels, axletrees, and other parts of carriages, and the working and other parts of machinery liable to shocks.

1373. John McCann, of Dublin, for improvements in the mode of, and apparatus for, drying, cooling, and cleaning grain.

The above bear date May 7th.

1374. John Hay, of Troon, Ayrshire, N.B., for improved arrangements to facilitate the cleaning and repairing of ships' bottoms.

1375. William Peel Gaulton and Major Booth, both of Manchester, for improvements in apparatus or machinery for damping and steaming fabrics; part of which improvements are applicable for distributing fluids for other purposes.

1376. William Riddle, of Gerrard-street, Islington, for improvements in hydraulic and other presses, and apparatus used therewith; adapted to packing cotton and other fibrous substances.

1378. William Southwood, of Kensington, for improvements in machinery for pulverizing ores, and extracting metals therefrom; part of which is applicable to breaking stones.

1379. John Fowler, of Leeds, and John King, of Chadshunt, Warwickshire, for improvements in apparatus for tilling land by steam power.

1380. Peter Tate, of Park-terrace, Kennington, for improvements in smelting furnaces,—being a communication.

1381. Charles Lungley, of Deptford, for improvements in apparatus for manœuvring ships and vessels.

1382. George Charles Grimes, of Wandle-terrace, Wandsworth, for improvements in the manufacture of cigar lights, splints, matches, and tapers or vestas, and in machinery or apparatus employed therein.

1383. Astley Paston Price, of Lincoln's-inn-fields, for improvements in straps or bands for securing articles, parcels, or luggage.

1384. Arthur Kinder, of Cannon-street, for improvements in the manufacture of sheet metal.

1385. Leo de la Peyrouse, of Panton-square, for improvements in treating neutral and acid, fatty, or oily substances, resins and resinous substances, and compounds or products containing paraffin.

1386. Nathaniel Thompson, of Birmingham, for improvements in barometers,—being a communication.

The above bear date May 8th.

1387. George Frederick Greiner and James Henry Carr Sandilands, both of Golden-square, for improvements in the construction of pianofortes.

1388. Thomas McIlroy, of Brampton, Canada West, for an improved invalid bedstead.

1390. Thomas Kemp Mace, of Birmingham, for improvements in guards or protectors for hats and other coverings for the head.

1391. William Eddington, jun., of Chelmsford, for improvements in portable grinding, chaff cutting, and corn crushing machinery.

1392. Francis Frederick Burdett Mayall, of Warrington, for improvements in dyeing mixed or plain fabrics and yarns.

1393. James Fox Bland, of Dorset-square, for an improved method of, and apparatus for, signalling between targets and shooters.

1394. Thomas Fawcett, junior, of Lisburn, Ireland, for improvements in plaited fabrics for shirt fronts and other uses, and in the mode of, and mechanism for, manufacturing the same.

1395. James Oxley, of Frome, for improvements in apparatus for facilitating the processes of mashing and sparging in breweries and distilleries.

1396. Thomas Welton, of Grafton-street, Fitzroy-square, for improvements in the preparation of beverages in connection with brewing.

1397. Nathaniel Symons, of Cambridge-street, St. Pancras, for improvements of all kinds of wheels, framework, girders, columns, and stancheons; blades of blowing fans, and paddle wheels for steam vessels.

1398. Francis John Bolton, of Bolton-row, Mayfair, for improvements in telegraphing for naval and military and other purposes, and in the apparatus connected therewith.

1399. Francis John Bolton, of Bolton-row, May-fair, for an improved mode of, and apparatus for, displaying the lights in lighthouses.

The above bear date May 9th.

1400. George Carter Haseler, of Birmingham, for improvements in the manufacture of lockets, and of a new application of Parkesine as a substitute for glass, in the construction of lockets and other articles of jewellery.

1401. Jacob Geoghegan Willans, of Belfast, for improvements in the treatment of the product from iron blast furnaces (whether moulded or otherwise), usually termed pig or cast iron or castings.

1402. John Frederic Milward, of Redditch, for improvements in breech-loading fire-arms,—being a communication.

1403. William Clark, of Chancery-lane, for the application of a vegetable fibre, alone or in combination with other matters, in the manufacture of felted and other fabrics, also as a substitute for flock or powdered wool, and as a material for padding or stuffing, and for other useful purposes,—being a communication.

1404. Robert Moore, of Cannon-street West, for improved apparatus for indicating the presence, position, or accumulation of liquids, gases, or vapors, and apparatus for preventing danger or damage consequent thereon.

1405. Robert Moore, of Cannon-street West, City, for improvements in the structure and appliances of ships and other vessels.

1406. John Thomas Cooke, of Leicester, for improvements in battens used in weaving.

1407. Richard Willoughby, of Mildmay-road, Middlesex, for improved apparatus for exhibiting and giving rotatory and traversing motion to placards, advertisements, scenes, and other objects.

1408. Henry Dyson Taylor and Edward Robinson, both of Huddersfield, for improvements in piece-dyed woollen fabrics, or fabrics composed of wool in combination with other fibrous substances.

1409. James House, of Market Lavington, for improvements in machinery or apparatus for crushing or reducing substances.

1410. William Henry Ronald, of Montrose, for improvements in apparatus for signalling and indicating the position of shots in rifle practice.

1411. Emerich Kolbenheyer, of Vienna, for an improved apparatus for making ices and cold beverages.

1412. Jean Baptiste Cristofini, of Paris, for improvements in tents.

1413. William Clark, of Chancery-lane, for improvements in lamps, and in apparatus for filling lamps with oil or fluid to be consumed,—being a communication.

1414. Henry William Sambidge, of Birmingham, for improvements in sliding chandeliers, gasaliers, and other pendent lamps.

The above bear date May 10th.

1415. Henry Walker, of Gresham-street, for improvements in making handles for crochet needles, pencils, penholders, and other articles.

1416. John Milnes, of Gloucester, for improvements in portable apparatus for exercising the human body.

1417. Gustave Fuhrmann, of Paris, for improvements in melting and boring

cast-steel barrels; applicable to fire-arms and pieces of ordnance,—being a communication.

1418. William Clark, of Chancery-lane, for improvements in smoke-consuming fire grates,—being a communication.

1419. John Buckingham Pope, of the West Riding and Haigh Moor Collieries, near Leeds, for improvements in apparatus for lowering and loading coals, minerals, or other substances.

1420. Charles James Harris, of King William-street, Charing-cross, for improvements in the manufacture of detector season or non-transferable tickets.

1421. Henry Stockton Firman, of Great Suffolk-street, Southwark, for improvements in apparatus for washing and cleansing textile fabrics or raw materials, and for forcing fluids or moisture from the same,—being a communication.

1422. John Henry Johnson, of Lincoln's-inn-fields, for improvements in casting metals, and in the moulds and cores employed therein,—being a communication.

1423. Henry Bayley, of Staleybridge, Leopold Newton, of Oldham, and John Greaves, of Staleybridge, for improvements in machinery for turning, boring, cutting, shaping, and reducing wood and other substances; applicable for the manufacture of various articles.

1424. Henry Cartwright, of the Dean, Broseley, Salop, for improvements in propelling and steering screw steam vessels.

1425. William Nelson Hutchinson, of Plymouth, for an improvement in screw-propelled ships.

1427. Handel Ashworth, of Hyde, for improvements in machinery for opening and carding cotton and other fibrous substances.

1428. James Leonard Wilson, of St. John-street, Smithfield, for improvements in calendering woven fabrics, and in the apparatus employed for this purpose.

1429. Alexander Bankier Freeland, of Chatham-terrace, Upper Norwood, for improvements in the preparation or treatment of hops.

1430. Ernst Ferdinand Lansky, of Nottingham-street, Sheffield, for an improved mode of, and apparatus for, working railway carriage brakes.

1431. Thomas Buckney, of Peckham Rye, for improvements in portable "tell-tale" timekeepers,—being a communication.

The above bear date May 12th.

1432. Samuel Bradley Ardrey, of Birmingham, and Samuel Beckett, of Oldham, for improvements in machinery or apparatus for manufacturing spindles; part of which apparatus is also applicable to grinding and polishing other articles.

1433. John Henry Johnson, of Lincoln's-inn-fields, for improvements in the mode of carrying out submerged and other engineering works,—being a communication.

1435. Pierre Martinez Lopez, of Paris, for improvements in apparatus for sowing wheat or other grain or seeds.

1436. John Beaujour Sardy, of New York, for improvements in the construction of ships of war and other vessels.

1437. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in coffee pots and boilers for culinary purposes; part of which improvements are also applicable for generating steam,—being a communication.

1438. Arthur Wormull, of Old Fish-street, for improvements in trepanning instruments.

1439. Gideon Blake, of Trowbridge, Wilts, for improvements in apparatus for warming apartments.

1440. John Henry Johnson, of Lincoln's-inn-fields, for improvements in the purification of colza, rape, and other oils,—being a communication.

1441. Robert Andrew Boyd, of Duke-street, Southwark, for improvements in the manufacture of bacon.

1442. James Sivewright, of Ravenhead, St. Helen's, Lancashire, for improvements in the manufacture of polished plate glass.

1443. William Clark, of Chancery-lane, for improvements in apparatus for generating motion in fluids; applicable for raising and forcing water, propelling, and otherwise in the

distribution of motive power,—being a communication.

1444. William Hartican, of Brighton, for improvements in fire-escape apparatus.

1445. Richard Archibald Brooman, of Fleet-street, for an improved means or apparatus for shunting trains,—being a communication.

1446. Richard Archibald Brooman, of Fleet-street, for improvements in louvre blinds or shutters,—being a communication.

1447. William Southwood, of Kensington, for improvements in machinery for manufacturing nails from either hot or cold bars of iron or other metal.

1448. Robert Marsden Latham, of Fleet-street, for improvements in steering apparatus,—being a communication.

The above bear date May 13*th.*

1450. Charles Talbot Porter, of New York, for improvements in steam engine indicators,—being a communication.

1451. Henri Charles-Réné Joubert, of Maddox-street, for improvements in raising music chairs, stools, or seats.

1452. Frederick Tolhausen, of Paris, for improvements in the manufacture of velvets,—being a communication.

1453. Richard Archibald Brooman, of Fleet-street, for an improved method and apparatus for the production of photographic and stereoscopic portraits and pictures,—being a communication.

1454. John Ward Girdlestone, of Birkenhead, for improvements in projectiles.

1455. Henry Deacon, of Appleton, Lancashire, for improvements in the manufacture and production of certain colors, and in the apparatus employed therein.

1456. Andrew Smith, of Mauchline, Ayrshire, for improvements in balances for weighing letters and other documents.

1457. Edwin Whittaker and Jeremiah Clare, both of Hurst, Lancashire, for improvements in machinery or apparatus for preparing cotton or other fibrous materials to be spun.

1458. Henri Gustave Delvigne, of Paris, for improvements in fire-arms.

1459. John Smith, senior, of Coven, near Wolverhampton, for improvements in thrashing machines.

1460. John Charles Brant, of Forston-street, City-road, for improvements in the construction of armour-plated ships, and in cements or compositions for uniting iron to iron, and for uniting other substances; which compositions may also be used for caulking and for coating ships' bottoms.

1461. Adolphe Nicole, of Soho-square, for improvements in stop watches and timekeepers, and in instruments for measuring accurately short intervals of time.

The above bear date May 14*th.*

1462. James Fletcher and John William Fuller, both of Salford, for improvements in machinery for rolling, bending, and planing metals.

1463. Thomas Henry Le Mesurier, of St. Peter's Port, Guernsey, for improvements in raising sunken vessels and other heavy bodies.

1464. George Henry Sanborn, of Fleet-street, for improvements in machinery for spinning,—being a communication.

1465. Robert Walsham and Josiah Walsham, both of Birmingham, for a new or improved sleeve tie or fastener.

1466. Jean Pierre Jouvin, of Rochefort-sur-Mer, France, for an improved process for preserving iron plated and other vessels and metallic articles from oxidation, and preventing ships' bottoms from fouling.

1467. John Dicker, of Hendon, for improvements in apparatus for the delivery of bags or parcels from railway trains in motion.

1468. William Sissons, of Kingston-upon-Hull, for improvements in machinery for driving piles by means of steam hammers.

1469. George Henry Birkbeck, of Southampton-buildings, for improvements in apparatus for consuming smoke,—being a communication.

1470. Josiah Stone, of High-street,

Deptford, for improvements in Downton's ship bilge pumps and fire engines.

1472. James Wright, of Bridge-street, Blackfriars, for improvements in machinery for digging, excavating, and removing earth, gravel, and such like substances,—being a communication.

1473. Charles Attwood, of Tow Law Iron Works, Durham, for improvements in the production or manufacture of steel and iron of a steely quality.

1474. Cooper Tress, of Blackfriars-road, for improvements in the manufacture of hats, helmets, bonnets, or caps.

1475. Isham Baggs, of Cambridge-terrace, and William Simpson, of Maidstone, for improvements in treating straw, Spanish grass, and other vegetable fibres; in preparing a bleaching agent for vegetable fibres; and in recovering and treating an alkali resulting from the treatment of the said fibres; and in apparatuses employed therein.

1476. Charles Girardet, of Vienna, for an improved construction of buckle.

1477. Alfred Watney, of Upper Berkeley-street, Portman-square, for improvements in constructing ships, vessels, and other structures intended to resist shot.

The above bear date May 15th.

1478. Perceval Moses Parsons, of Blackheath, for improvements in ordnance and other firearms, and in tools for rifling the same.

1479. John Railton and Thomas Railton, both of Blackburn, for improvements in warping machines.

1480. George Haseltine, of Fleet-street, for improvements in churns,—being a communication.

1481. Rest Fenner, of Red Lion-court, Fleet-street, for improved machinery for folding envelopes.

1482. Richard Laming, of Priory-road, Kilburn, for improvements in constructing and using electric telegraphs.

1483. Christopher Binks, of Parliament-street, for improved methods of, and apparatus for, treating linseed and other oils and fats.

1484. Amand Athanase Lamiable, of Paris, for improvements in cementing cast and wrought iron, to obtain cast steel.

1485. Albert Louis Thirion, of Aisch en Refail, Belgium, for improvements in the construction of railway and other carriages.

1486. Frederick Bonaparte Anderson, of Birmingham, for improvements in watches and other time keepers.

1487. Dudley Charles Le Souëf, of Twickenham, for improvements in embossing metal plates,—being a communication.

1488. George Davies, of Serle-street, for improvements in the manufacture of ribs for umbrellas and parasols; part of which is applicable to the hardening of strips of steel generally,—being a communication.

1489. Samuel Peberdy, of Philadelphia, for improvements in apparatus for knitting ribbed fabrics.

1491. Nathan Thompson, of Abbey-gardens, St. John's Wood, for improvements in stoppers or covers suitable for closing bottles, jars, and other similar vessels.

1492. Frederick Stocken, of Halkin-street, Grosvenor-place, for improvements in carriages.

1493. Benjamin Sharpe, of Hanwell-park, for improvements in the construction of ships and vessels, and in masts and spars for the same.

1494. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improved machinery applicable to the cutting of leather and other like uses,—being a communication.

1495. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improved machinery applicable to the cutting out of boot and shoe soles and kindred operations,—being a communication.

The above bear date May 16th.

1496. Christoper Binks, of Parliament-street, for improved methods of obtaining oxygen and chlorine gases.

1498. Robert Davison, of London-street, and Thomas Johnson, of Bermondsey, for improvements in machines for washing and cleansing casks.

1499. Edouard Tailbouis, of Paris, for

improvements in rectilineal knitting frames.

1500. James Hogg, junior, of Twickenham, for improvements in book covers.

1501. James Broadley, of Saltaire, Yorkshire, for improvements in means or apparatus employed in weaving.

1502. James Charles Hill, of Abergavenny, and David Caddick, of Ebbw Vale, for improvements in puddling furnaces.

1503. Joseph Needham, of Piccadilly, for improvements in sheathing or coating iron ships.

1506. Frederick Elsworth Sickels, of New York, for an improved apparatus for steering vessels.

1507. John Christopher Gore, of Jamaica-plain, Massachusetts, U.S.A., for improvements in belt shippers.

The above bear date May 17th.

1508. James Wright, of Bridge-street, Blackfriars, for an improved method of sheathing iron or metal ships, in order to protect them from the action of salt water, fouling, and other such like influences.

1509. James Eastwood, of Blackburn, for improvements in machinery or apparatus for removing and wringing hanks of thread or yarns, and all kinds of fabrics when saturated with liquid.

1510. Robert Ramsden, the younger, of Kingsland-road, for improvements in machinery or apparatus for mashing malt.

1511. George Macdonald, of Puttorghatta, Colgang, Bengal, for improved apparatus for ginning cotton, and for cleaning and preparing fibrous substances; also applicable for cleaning or polishing metal or other substances.

1512. Felton Charles Kirkman, of Crouchend, and Richard Swift, of Hounslow, for a new and improved joint for uniting or fixing posts and rails of bedsteads and other articles of furniture; posts and rails in fencing; in the construction of framework for conservatories, and emigrants' and other portable houses.

1513. William Pickstone, of Radcliffe, and Thomas Mellodew, of Oldham, for an improved fabric in the nature of a cord or corduroy.

1514. Jesse Lee, of Leicester, for improvements in the construction of traction engines.

1515. Timothy Morris, Robert Weare, and Edward Henry Cradock Monckton, all of Trafalgar-square, for improvements in the means and apparatus for the protection of life and property by the agency of electricity.

1518. Marc Antoine François Mennons, of Paris, for improvements in certain descriptions of breech-loading fire-arms,—being a communication.

The above bear date May 19th.

New Patents Sealed.

1861.

2122. H. Nelson, J. Carr, & G. Harrison.
2944. John Weems.
2948. William Bray.
2950. Fédor De Wyldé.
2952. J. B. Hulard and L. G. Poupel.
2955. James Ronald.
2957. William Burgess.
2960. J. H. Johnson.
2963. George Clarke.
2970. William Sellers.
2975. William Firth and R. Ridley.
2977. G. E. Donisthorpe, W. Firth, and R. Ridley.
2979. John Standfield.
2981. F. F. Dumarchey.
2991. William Clark.
2995. William Rowan.
3000. J. M. Rowan.
3002. Peter Spence.
3006. Benjamin Pitt.
3008. L. H. C. J. Carle.
3019. J. Cooper and C. Garrood.
3022. James Wakenell.
3024. Gerard Ralston.
3025. T. W. G. Treeby.
3026. R. A. Rust.
3028. J. H. Glew.
3030. James Leach.
3032. J. L. Field.
3035. W. E. Gedge.
3036. James Hemingway.
3040. H. G. Hacker.
3042. R. Kennedy and J. Armstrong.
3044. R. A. Brooman.

3048. John Knowelden.
3052. James Cochrane.
3055. Michael Henry.
3057. A. R. and W. Woodward.
3058. J. Bailey and W. H. Bailey.
3060. J. D. Napier.
3065. H. G. Schramm.
3067. Thomas Lawes.
3068. George Clark.
3069. Richard Jolly.
3072. W. N. Hutchinson.
3075. T. Mellodew, C. W. Kesselmeyer, and J. M. Worrall.
3076. B. W. Gerland.
3082. John Fordred.
3083. R. A. Brooman.
3087. William Clark.
3090. Hector Alexander.
3093. J. A. J. Redier.
3094. V. L. Daguzan.
3099. David Vogl.
3106. R. A. Brooman.
3108. W. H. Tooth and W. Yates, junior.
3109. John Potter.
3110. John Leeming.
3111. Richard Searle.
3113. William Lightfoot.
3114. W. W. Godfrey.
3115. W. E. Wiley.
3117. W. S. Longridge.
3118. Augustus Tonnar.
3119. J. W. Scott.
3120. J. D. Jobin.
3123. S. B. Hewett.
3126. H. J. Holding.
3129. J. W. Friend.
3130. Thomas Walker.
3131. T. B. Gibson.
3133. Pierre Quantin.
3136. J. Hetherington, T. Webb, and J. Craig.
3137. H. Appleby and H. Harrison.
3140. R. A. Brooman.
3141. R. A. Brooman.
3143. J. E. Duyck.
3148. William Husband.
3150. Emile Cajot.
3151. John Willis, jun.
3152. G. P. Vallas.
3154. W. Bartram and W. S. Harwood.
3155. David Chalmers.
3156. John Aitken.
3157. W. G. Laws.
3158. Charles Baumann.
3159. W. H. Tucker.
3162. Robert Shaw.
3163. John Dale.
3165. J. Platt and W. Richardson.
3166. Robert Scott.
3167. Samuel Sheppard.
3173. John Piddington.
3177. J. M. H. A. Taurines.
3178. James Bannehr.
3179. Charles Pontifex.
3180. William Betts.
3181. Theodore Bourne.
3183. Eli Stott.
3184. J. H. G. Wells.
3185. A. Treuille and F. X. Traxler.
3196. William Clark.
3206. William Bennetts.
3209. W. L. Allchin and W. Allchin.
3214. J. H. Johnson.
3223. E. B. Sampson.
3226. John Cochrane.
3245. James McIntyre.
3249. Edward Lord.
3250. Arthur Warner.
3257. W. E. Newton.
3263. T. Green and R. Mathers.
3269. W. H. Bailey.

1862.

17. J. J. Guthnecht.
38. John Coryton.
70. A. R. Le Mire de Normandy.
82. Henry Charlton.
106. William Gorie.
151. J. A. Knight.
177. J. C. Johnson.
199. John Wright.
240. W. E. Newton.
309. A. V. Newton.
327. A. McKenzie and F. Panthel.
368. Thomas Coltman.
387. Richard Hornsby, jun.
412. Richard Bunting.
475. G. T. Bousfield.
478. J. P. D. Camp.
510. Joseph Whitworth.
555. James Sim.
584. F. B. Houghton.
599. J. Chubb and H. M. Burton.
667. W. H. Latham and F. C. W. Latham.
668. W. H. Latham and F. C. W. Latham.
700. John Kent.
722. John Avery.
737. William Barber.
794. Thomas Marsh.
829. J. T. Loft.
832. John Wilson.
841. W. L. Winans.
844. William Greenway.
903. Henry Pooley, junior.
933. J. T. Loft.
1101. James Mackay.

*** *For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.*

NEWTON'S

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The International Exhibition.

To make the most of the opportunity for instruction afforded by the International Exhibition, it may be well to regard this great display as a text-book open to comment, after the manner best suited to the character of those who are called upon to write for the instruction of others. In this way, an essay worthy of attention may be obtained from one pen, an analytical examination of the state of some branch of manufacture from another, and suggestions for improvements in another direction from a third, according to the bent of mind of the respective writers. With this preface, which will serve to explain the want of uniformity in our papers, we proceed with our notices of the Exhibition.

ON THE INTRODUCTION OF NEW MATERIALS INTO COMMERCE.

With respect to their influence upon manufactures and the industrial arts, there are two very broadly distinct objects to be attained by exhibitions of the products of industry similar to that which is at the present moment displaying its treasures at South Kensington; leaving on one side all considerations of the indirect influence exerted over the general taste by a more extended acquaintance with objects of utility and beauty, and the enlargement of the understanding, which cannot fail to arise from the contemplation of the natural and artificial productions of all the countries of the earth, brought into comparison in one spot. These two objects are—first, the advantages arising directly to manufacturers by the stimulus of competition, and the opportunity of comparing, in the closest manner, the productions of similar branches of manufacture, and of noting, from time to time, the improvements made in them. Secondly, the indirect advantage accruing from the tendency of these exhibitions to excite observant and ingenious men to seek for novelties in substances which may be made to supersede materials already in use, or which may become the subject of manufactures altogether new.

The riches of nature are so various in quality and boundless in extent, that it mostly happens here, as under other circumstances, that demand and supply go hand-in-hand together. It is but seldom that a great necessity for a suitable material in manufactures remains long unsatisfied; and it appears that these industrial exhibitions operate, in some degree, as an immense exchange, in which such necessities make themselves

known to many an untiring explorer, who carries away to far-off lands the remembrance of these trade requirements—perhaps to bear fruit at a future time, in the shape of importations of new and beautiful woods, or plants, or animal substances, admirably suited to some purpose in the industrial arts.

There are but few of the visitors to the International Exhibition—particularly to the parts of it devoted to foreign countries, especially distant tropical countries and the colonies—who, we imagine, are not impressed with wonder at the many strange objects in new and curious materials that are presented to their view for the first time; this was, perhaps, more strikingly the case with the Exhibition of 1851 than with that now open. However this may be, there is unquestionably, in the present Exhibition, an abundance of novel objects, among which, perhaps, none is more remarkable, in its general characters, than that which has called forth the above remarks.

In the Haytian court—somewhat inconsistently, as it is the sole representative of the great colony of the Cape of Good Hope—there stands a stall devoted to the exhibition of various South African productions: woods, fibrous materials for spinning or paper making, and other curious and supposed-to-be useful matters. Among these, occupying a prominent position, are a great variety of articles—walking-sticks, umbrella-handles, picture-frames, inlaid work, medallions, and objects worked in relief—all constructed from a most unusual, perhaps quite unknown, material, as applied to such purposes, viz., *sea-weed*. The discovery of the applicability of this substance to the useful arts is one of the instances which sometimes occur, where materials, abundantly supplied by nature, remain for ages altogether unapplied to any use, although, as in the present case, they are familiarly known even to whole communities. The kind of sea-weed from which the articles mentioned are formed, abounds on the coasts of southern Africa, where it is cast up by the sea, and has been trodden under foot time out of mind. It never seems to have occurred to anyone to examine its character, consequently it remained of no more value than the commonest sea-weed of our own coast, until it arrested the attention of Mr. Thomas Ghislin, who made some experimental investigations concerning its properties, and now proposes it as a most valuable material for many useful and ornamental purposes in the arts.

The species of sea-weed to which this new application belongs is the *Laminaria*, the particular variety being the *Laminaria buccinalis*. This very extraordinary substance grows in the sea, in large bunches, rising from one stalk or root; the bunches being composed of a number of hollow pods or fronds, which sometimes grow to a great length and considerable size. The point by which these spring from the parent plant is solid, but in the course of a few inches, even where the plant is large, it becomes tubular, and gradually increases in diameter, until, at its distal extremity, it is rounded off, and terminates in a fringed process or sort of leaf. This frond being a hollow close vessel, and filled with air, floats in the water, attached only by a comparatively slender stalk. The size and, in some degree, the shape of these remarkable vegetable growths vary; in some the expansion from the small solid attaching stalk to the large extremity is rapid; and specimens, commencing with a tube of half an inch in diameter, acquire a diameter of

three inches or more in a length of 18 to 20 inches; these resemble an elongated bottle, and have a considerable internal capacity. Some specimens expand very gradually, the difference in diameter, in the course of three or four feet, not exceeding half an inch; and one specimen, brought to England by Mr. Ghislin, was 26 feet in length, 1 inch at the small, and three inches in diameter at the larger, extremity. Of course, there are no means of gaining much knowledge respecting the size to which this plant may attain, as the only specimens that have been seen had been torn off, and cast up by the waves. It grows in deep water, and it is, therefore, impossible to say what size it may reach, or if it might not, in some instances, have acquired such a size as, when seen tossed about upon the surface of the sea, to have given rise, in an imaginative mind, to accredited accounts of veritable sea-serpents. The great sea Tang is said to grow to more than a hundred feet in length, and it is not improbable that a size much more considerable than that of any of the specimens obtained, may be reached by the *Laminaria buccinalis*.

The most remarkable character of this plant, however, is not its size, but the peculiar physical conformation of its exterior, which resembles, in the closest manner, buckhorn. The outer coating or cuticle is of a dark color, and, in its natural state, appears nodulated and uneven; as it dries up, after being removed from the water, this surface contracts, and the nodules shrink and draw together, giving exactly the appearance mentioned. When it is fresh, the substance of the plant is thick and fleshy, but, as it dries, it altogether loses this character, and becomes thin, compact, and hard—extremely like horn in texture, and having an external surface exactly like stags' horn, of the most beautiful grain. In its natural state, this substance is hygrometric in a very high degree, and even after it has been completely dried and hardened, it can be restored to its original soft, fleshy condition by steeping in water. Whilst thus soft, it can be brought into almost any shape, and, if then dried, will retain that shape permanently—indeed, it can be handled, stretched, and bent into any required form, very much like a tube of thoroughly soaked leather. Neither is this the end of the curious properties of this substance; for if it be reduced to powder whilst dry, and the powder be wetted and forcibly pressed into a mould, the particles will cohere, and come out of the mould with an impression such as would be obtained with gutta-percha. The plant contains a kind of gummy matter, which, like many gums, is almost insoluble in water, although it absorbs it, and swells to a great thickness; enough of this gum is, however, soluble to cement the particles of powder together, and so to form a hard cohering mass when it is removed from the mould.

Mr. Ghislin, who is the first to propose any practical application of this substance, does not quite leave the subject in that crude form, but comes prepared likewise to tell manufacturers how the material is to be used; as he has devised a process which enables him to remove from it its hygrometric character, and to bring it into the different conditions illustrated in his collection at the International Exhibition.*

* For a description of this process, for which a patent has been obtained, see page 89. We are happy to learn that Mr. Ghislin has received a medal for his ingenious and important applications of the prepared sea-weed.

This appears to us to be a striking example of the unquestionable fact, that these public contests for superiority in the arts and manufactures are ever productive of the indirect advantages which we mentioned above, and that many and continued benefits cannot fail to arise out of them, independently of their immediate effects. T. W. K.

MILITARY ENGINEERING AND APPLIANCES.

We last month noticed some of the most noteworthy articles exhibited under the head of ordnance and projectiles, and in briefly referring to fire-arms we stated what were the *desiderata* in breech-loading fire-arms. These remarks were by no means intended to condemn this class of arm, for its use as an occasional weapon must be admitted on all hands. The amount of ingenuity that has been expended on breech-loading contrivances is really surprising, and there are not wanting military men of high standing who are firmly persuaded that one or other of the numerous schemes that have been recently brought to light will provide a reliable weapon of this class for the common soldier. Elaborate calculations have even been made as to the practical effect that breech-loading fire-arms will have upon the question of offence and defence; in fact Colonel Adair, in his great model, to which we shall presently refer, bases his means of defence in a great measure upon the effective use of this class of weapon.

Fortifications, Field Works, Bridges, and Tents.

The fortification of the metropolis has recently been the subject of so much discussion, that we cannot be surprised at finding, in the International Exhibition, proposals for effecting this object. The elaborate and beautiful model of Colonel Adair, although involving no novelty of invention (which is our special province), must not be passed unnoticed. This model shows the defensive capabilities of London, aided by forts, redoubts, and continuous lines, on an area of 22 × 14 miles, and extending for 50 miles. The octagon of defence includes on the S.E. Woolwich and Anerley, on the S. and S.W. Kingston and Twickenham, on the N. and N.W. Hendon and Harrow, and on the E. and N.E. East Ham and Stamford Hill. Each face of the polygon represents a defensive line of battle, having works at the angles, as *points d'appui*, with intermediate works for supports. The forts and permanent works are on the German system, and are adapted for prolonged resistance. The lines are completely swept by flanking fire, and are observed from behind by the permanent works. They are proposed to be constructed in earth, with scarps of concrete, and they are traced with a view to assist the defence by inundations at various points. Colonel Adair estimates that 14,921 acres, at a cost of £1,492,100, will be required for the forts, lines, and works. The construction of the works would cost £2,283,825, and the guns, of which 1801 would be required, excluding carronades, are estimated at £360,200, making a total of £4,136,125,—a pretty round sum, which, in the carrying out of the works, might possibly be doubled.

Some very beautiful and interesting models of land defences, proposed to be constructed at Plymouth, Portsmouth, and elsewhere, and

also of proposed barracks, are exhibited by the Secretary of War, Colonel Collinson, and others. The fortifications are constructed upon the Prussian or modern German system, upon an extended polygon, with casemated works, and a large provision for vertical fire. There does not, however, appear to be anything particularly novel in the construction or arrangement of the works.

Captain Ducane, R.E., exhibits an ingenious mode of constructing iron forts by which he has contrived to casemate or protect all his guns, and, moreover, to do so in such a manner as to obtain so overpowering an amount of direct fire, that it would be impossible to construct any siege or other works of offence within range. His defensive plates are made of narrow dimensions, and are constructed on the tongue and groove principle, with vertical supports behind, so that no bolt-holes are required to secure the plates in their place. Captain Ducane proposes to employ two or three tiers of guns, one above the other, and the face of the fort, above the lowermost tier, is inclined at an angle of 45°, so that there will be great difficulty in penetrating the defensive wall of the fort. If some parts of Captain Ducane's plan are open to criticism, it certainly contains much that is well deserving of consideration, as it is quite certain that no walls that can be constructed of masonry would sustain even a moderate amount of battering from the heavy ordnance that is now in use; we must, therefore, eventually resort, as have the Confederates at Fort Darling, to iron as a protection from the ponderous missiles now employed in warfare, or in some other way improve the defensive powers of our fortresses. Another and most ingenious application of iron as a means of defence is shown in a model, to scale, of a revolving fort, exhibited by Mr. Minton. The fort is constructed entirely of sheet or plate iron, and is provided with a low conical roof, to protect the inmates from the effects of vertical fire. The structure is made buoyant, and floats in a tank or excavation filled with water. Any convenient number of guns of heavy calibre are placed on what may be termed the upper deck, under the protection of the conical roof, and project through port holes, which occur at suitable intervals around the structure. The interior of the fort affords living accommodation for the garrison, and leaves plenty of room for ammunition and stores. Access to the interior is obtained by means of a subterranean passage, which is well protected from surprise. The fort is surrounded by a narrow ditch, which will prevent an attacking force from coming up to the sides. The object of rendering the structure buoyant in water is to admit of its rotating on its axis with facility, by means of gearing worked from the inside. The arrangement of the guns is such that all may be brought in succession to bear on any given object, by turning the fort on its axis: the reloading of the discharged guns will take place while the others are being fired. By this means as constant and rapid a fire may be kept up as if a very heavy battery were constructed on the spot. The gunners, moreover, will be perfectly protected.

In reference to field fortifications and field works generally, there are but three exhibitors. Serjeant Major Jones, of the Royal Engineers, exhibits models of his iron band gabion and sap roller, which is now used in the service, and shows the application of the iron bands

to several other purposes, such as the construction of field suspension bridges, floating or pontoon bridges, field bedsteads, ambulance litters, rafters for field hospitals, stabling, and huts, and also as a field trip, for creating obstructions in the dark to the advance of an enemy, either cavalry, artillery, or even infantry. The ingenious way in which Mr. Jones has contrived to make a single article applicable for a variety of purposes, without rendering it inapplicable for its orginal use, when no longer required for the temporary purpose, is entitled to great commendation. The manufacture of gabions in the ordinary manner is a lengthy and somewhat troublesome operation, requiring skilled workmen, whereas, by Serjeant Jones's plan (the iron bands and pickets having been provided), a gabion could be prepared, ready for use, by by two men in less than five minutes. The cost of each gabion will be about 8*s.* 6*d.*, but as they are practically indestructible, except by violence, the cost is not material. In constructing suspension bridges for the passage of infantry, the bands are connected together in suitable lengths, and arranged side by side, like warp threads,—the wooden or iron pickets being interwoven between them. A bridge of this kind, of considerable strength, could be constructed in a very short time.

As a result of the volunteer movement, Lieutenant W. E. Newton, of the 1st Middlesex Volunteer Engineers, also exhibits a new gabion, of his designing, intended to secure lightness, strength, durability, cheapness, and facility of construction and transport. It consists of galvanized iron wire netting, bent into a cylindrical form, and lined with roofing felt, and supported with iron or wooden pickets. The inventor proposes that these materials should be kept ready prepared, in suitable lengths for gabions or sap rollers, or kept in store in long lengths or rolls, which may be cut up when required into the proper lengths. The cost of these gabions is under 3*s.*, and two men can make ten of them ready for use in less than an hour. A portion of a parapet constructed with these gabions, to a scale of one-sixth the real size, is exhibited. It is also proposed to revet the interior slope of the parapet, and also the cheeks of embrasures, with the lined wirework, laid out flat; and a model, to scale, of this revetment is also shown. This material it is proposed to apply, in long lengths, for the foundation (with the addition of a few planks) of temporary roads, for the passage of troops over marshy or unstable land.

Mr. Newton also exhibits models illustrating a plan for preventing the injurious effects of concussion on the carriages and platforms of ordnance of various kinds. The invention consists in surrounding the trunnions of the gun with thick blocks of vulcanized india-rubber, which will deaden the recoil. For mortars, the carriage is also made to rest upon a bed of this material, which will neutralize the thrust. It is stated that these contrivances have been used by the United States army, in their present lamentable conflict, with great advantage.

Major Lovell exhibits an ingenious contrivance for protecting the sappers when driving a trench or sap in front of a besieged place. It consists of a large wrought iron dished shield, in form somewhat resembling an enormous spade. The sapper having made a hole, and entered it with his tools, places the disc or shield over him, or a little in advance, so that he can work under it without danger from the missiles of the enemy. The inventor claims that by employing these

shields the use of sap rollers may be dispensed with. A model, to scale, admirably illustrates, even to unprofessional minds, the utility of the invention.

The construction of draw-bridges, and the mechanical contrivances for working the same, appears to have received considerable attention from military officers and engineers. For obvious reasons, all mechanism employed in military operations should be as simple as possible in construction, and not liable to derangement; this remark bears especially on draw-bridges, doors, gates, and other contrivances for cutting off communication with different parts of a fortress. Models of several plans—all more or less ingenious—for constructing and working draw-bridges, or, as they are more generally termed, rolling bridges—are exhibited. Mr. Lucas exhibits a rolling bridge, which has been adopted by the Government for the Irish forts, and consists of a platform mounted at one end of a strong iron frame, the inner end of which is supported on either side by rollers. When the bridge is in place, the ends of the platform rest upon solid masonry, and its upper surface is then flush with the roadway at each end. It is raised from off its seat by means of levers, provided at their lower ends with antifriction rollers, on which the platform may be run back out of the way. There is nothing to get out of order—all counter-balance weights, chains, and other similar tackle, being dispensed with.

Captain Donelly, R.E., exhibits an ingenious construction of rolling draw-bridge. The improvement aimed at is to avoid making the draw-bridge twice the length of the opening to be bridged across, or the use of counterbalance weights. This he effects by employing a moveable diagonal strut or support, which, at its lower end, rests against the side wall, and, at its upper end, is provided with a roller, on which rests the platform of the bridge when it is lifted off the side walls for the purpose of being drawn back. The platform is moved to and fro by means of racks and pinions or by a mangle motion, and it is always supported by the diagonal strut while in motion; and when drawn completely back, the diagonal strut follows it, so as to leave the opening free for the passage of any vessel.

A model of a rolling bridge for forts, possessing many of the advantages of Captain Donelly's, and, in fact, closely resembling it in principle of construction, is exhibited by Mr. W. S. Dyer. The mechanical arrangements are somewhat too complex for the purpose, otherwise there is no reason to doubt that it would answer the intended purpose equally well with the others.

So much has been done lately for the comfort and convenience of the soldier, that it would be strange indeed if the Exhibition of 1862 afforded no examples of attempts at improving tents. There are several exhibitors who profess to have this end in view, but, with one or two exceptions the articles exhibited do not call for remark. The most noticeable improvement in tents is the invention of Major Rhodes, who has paid great attention to this subject. He exhibits a variety of designs of tents for various purposes, but they are all constructed much on the same plan: the canvas covering is mainly supported by elastic bars or ribs, arranged like the ribs of an umbrella. The lower ends of these bars are firmly secured in the ground, and their upper ends are inserted into a central socketed plate. The canvas is tightly

strained over the bent elastic bars, and the whole structure is so contrived as to give the greatest amount of internal accommodation with the least possible weight of canvas. This is a point which evidently has escaped the notice of other exhibitors, who have given all conceivable varieties of bell-shaped, square, octagonal, oblong, and round tents, but do not appear to have considered that it is a great *desideratum* that an army should be as little cumbered as possible with baggage.

Mr. Edgington's tents, although good as marquees for fêtes and pic-nics, utterly fail when tested by the strict requirements of a properly organized military tent for active service.

After Major Rhodes's tents, the most practically useful, for army purposes, is a tent exhibited by Mr. Turner, of Northfleet. It is a conical tent, provided with a central fire-place, the chimney of which forms the support of the tent. This idea is not new, but the whole design of the tent, together with its fittings and mode of ventilation, by means of a sliding hood, is ingenious. A screw-peg is used to secure the cords of his tents to the ground. The holding power thus obtained is so great, that a screw-peg weighing 1 lb. is capable, when screwed well into hard turf, of resisting a pull of between 700 and 800 lbs.

Recent Patents.

To JAMES FAWCETT, *of Wakefield, Yorkshire, for an improved material particularly adapted for the scouring, cleansing, and fulling of woollen or other cloths.*—[Dated 24th September, 1861.]

THIS invention consists in the manufacture of a preparation especially applicable to the purposes of scouring, cleansing, and fulling woollen and other cloths in the following manner:—Lichen or Iceland moss, or Irish or other moss containing gelatinous matter, is boiled until a liquid, forming a firm and strong jelly, is obtained. The liquor should be freed from the refuse or insoluble portions of the lichen by straining it, in order to obtain a clear and firm jelly.

Another process is, to dry the lichen or other moss, and grind it into a powder, and, when required for use, to add water, and either boil or steam the whole. By this mode of manufacture, a jelly is produced, which becomes perfectly free from residuum by straining. To the clear and firm jelly thus produced, soda ash or other alkali is intimately incorporated and mixed with the jelly, whereby a composition will be formed suitable for scouring or cleansing wollen or other cloths, or for other manufacturing purposes, effecting a great saving of soap and other materials which are commonly used for such purposes.

The patentee claims, "the manufacture of the material described, as fully specified, for the purposes set forth."

To Robert Smith *of Chorlton-upon-Medlock, and* John Barnouin Rowcliffe, *of Manchester, for improvements in apparatus for winding yarn or threads on the pin bobbins or spools used in smallware and ribbon looms.*—[Dated 17th October, 1861.]

This invention consists in so constructing pin winding machines that any required number of threads may be wound together, and with an even tension on each pin bobbin; also, when either or any of the pin bobbins is full, that the same will be disconnected from the driving power, and cease to take up any more thread or threads without affecting the remaining pin bobbins that are not sufficiently filled.

In Plate IV., fig. 1 represents a cross section of a machine constructed according to this invention. The yarns or threads are wound upon the pin bobbin or spool A, which rotates on its spindle in a swing frame B; motion being imparted from the constantly revolving shaft E, by means of the wheel and pinion D, and C. The rotation of the pin bobbin A, may be arrested by lifting the swing frame which turns on its axle F, and raising the pinion C, out of gear with the wheel D. G, G, G, are the threads taken from the bobbins L, L, that are to be wound together on the pin A. They pass in their course from the bobbins L, to the pin A, through the eyes, and support the ends of detective levers M, M, M, which turn loosely on the fixed centre N. The lever O, turns on the fixed axle *a*, and the end O[1], being a little heavier than the other, it rests against the frame Q, when the detective levers are supported by the threads. R, is a rod which traverses equal distances in alternate directions, and carries the rack S, which communicates motion to a quadrant T, fixed upon the stud working in the loose socket W; to the same stud is fixed an arm X, carrying the guide Y, which vibrates on the pin Z,—the other extremity being held steady by, and moving in a slot in, the fixing *b*. The threads G, G, pass through the eye *c*, fixed to the guide Y. The lever *d*, swings loosely on the stud *e*; the top arm rests against A, as it revolves, and the bottom arm presses against the guide Y, at d^1, the guide being held in contact by the cord and weight f, f^1; the cord passes over the pulley f^2, and is attached to the guide at f^3. One end of a spring *g*, is fast to the fixing *h*, and the other works in a slot in the starting lever *k*; when the wheel and pinion C, and D, are in gear, the lever *k*, is pressed backwards, to allow the swing fixing B, to be lowered, as shown. Upon the lever *k*, is a projection *l*. The lever *m*, turns upon the stud *n*, and projects over the end O[2], of the detective lever O. At the under side of the lever *m*, is a projection *p*, which, when the starting lever is in the position shown, holds back the lever *k*, by pressing against the projection *l*, and allows the weight of the fixing B, to hold the pinion C, in gear with the wheel D. At the end of the lever *d*, is an adjusting screw d^2, which comes immediately under the lever *m*, and is for the purpose of regulating the diameter of the pin to the size required.

To work the machine, the attendant first puts on to the spindle the empty pin bobbin or spool A, which is secured in its position by the small latch *q*; he then presses back the lever *k*, which allows the swing fixing B, to move upon its centre F, and put the wheel and pinion C, and D, into gear: the same movement of the lever *k*, allows the projection *p*, to lock itself with the setting on the lever at the projection *l*. The attendant then takes the ends of the threads (seeing that each passes through its proper detective lever), and makes them fast to the pin bobbin A,

which begins immediately to wind on the threads, and the threads will now sustain the detective levers M, M, M, and unless a breakage of any thread occurs, or one of the bobbins L, runs empty, they will be wound on the pin until it is filled; the weight of the detective levers giving a proper and equal tension to each thread, so that all will be wound on equally. Before passing through the guide c, the threads pass round a small upright roller r. The pin, as it enlarges in diameter, presses back the upper arm of the lever d, which turns on its centre e, and raises its lower part; and when the pin is the required size, the adjusting screw d^2, comes in contact with the lever m, raises it until the projection p, is clear of the projection l, on the lever k, and so allows the spring g, to force the lever k, forward; this movement of the lever k, lifts the swing fixing B, by means of the shoulder piece k^1, and lifts out of gear the pinion C, and so stops the pin from winding on any more thread. It will be readily seen, that the screw d^2, may be adjusted to arrest the motion of the pin A, sooner or later, according to the amount of thread or yarn that is required to be wound thereon.

The rotation of the pin is immediately stopped by disconnecting it from its driving power when any of the threads break, or when any of the bobbins L, are emptied. This is effected in the following manner:—The threads pass over the rods s^1, s^2, and through the eyes M^1, of the detective levers M, M, and the threads having a slight tension on them support the detective levers M, in the position shown. It will be seen that if any thread should break, or any bobbin become empty, the detective lever supported by that thread would fall on to the lever O: the additional weight of the lever M, makes this side of the lever the heaviest, and turns it upon its centre a, thus raising the opposite end O^2, until it comes in contact with the lever m, which it lifts, and stops the pin from winding on any more thread, in the manner before described; the attendant can now repair the breakage or replace the empty bobbin, and re-start the pin by pressing back the setting-on lever k.

Having thus shown how the pin is stopped when full, and also when a breakage occurs, or any of the threads run out, it will now be explained how the traverse is given to the guides which direct the thread on to the pin bobbin, and how the length of traverse is gradually shortened as the pin bobbin fills.

Figs. 2, 3, and 4 are detail views of various parts of the above described machine. t, is a wheel, which drives, through the gearing t^1, t^2, t^3, t^4, and t^5, the upright shaft u: on the extremity of the shaft is fixed a small pinion v, working into a mangle wheel w; and excentric to the centre of the mangle wheel is a pinion x, in gear with the quadrant lever y: this lever oscillates upon the stud y^1, and its upper arm gives the alternate motion to the traversing rod R, (see fig. 1) to which it is attached by suitable fixings z^1 and z^2. The traverse rod extends the whole length of any number of spindles that may be required to work, and always moves through the same space; on this rod R, opposite to each spindle is fastened a rack S, which works into the quadrant T, fixed on the stud working in the loose socket W; to this stud is also fixed the projecting arm X, carrying the guide Y, as before described; it will therefore be seen, that as the pin bobbin fills, and the lever d, moves upon its centre e, the lower part presses against the guide Y, at d^1, (both being kept against each other by the pull of a cord and weight) and

throws its upper end, where the thread is passing through, nearer to the centre of the quadrant stud W, and so gradually shortens its traverse, and forms the bobbin A; any desired degree of taper being obtained by shortening or lengthening the lower arm of the lever *d*.

When winding silk or any other fibrous substance that might be injured by the friction of the lever pressing the pin bobbin as it fills, the plan shown in figs. 3 and 4 is adopted. The traverse rod *n*, constantly works in alternate directions; to this rod is attached the small stud *a*, and turning loosely upon this stud is the ratchet *b*. The ratchet wheel *c*, is fixed to the short shaft *d*, one part of which forms a screw *e*, working into a nut; the projecting bar *f*, on this nut comes in contact with the lever *s*, when it is drawn forwards; on the lower side of this nut is a projection *g*, moving in a slot in the fixing *h*; this projection *g*, prevents the nut from turning round with the screw, and so causes it to be drawn along when a rotatory movement is given to the shaft *d*. K, is a small weight, with its cord coiled round the small fast pulley; *p*, is a curved arm springing from the stopping lever; *r*, is a ratchet, with its point so formed as to permit the ratchet wheel *c*, to rotate only in one direction.

Suppose now that the attendant has held the ratchets *b*, and *r*, out of gear with the ratchet wheel *c*, and allowed the weight K, to act upon the shaft *d*, and screw back the nut so that the lever is in the proper position to commence to fill the pin bobbin,—it will be seen that each time the traverse rod moves in the direction shown by the arrow, the ratchet *b*, will cause the ratchet wheel *c*, to turn the shaft *d*, and the ratchet *r*, will prevent any backward motion when the traverse rod makes its return movement. By thus causing the shaft *d*, to rotate, the nut is gradually drawn onward, and presses forward the lever *s*, until it raises the lever *m*, and causes it to stop the pin bobbin, as before described in fig. 1. The attendant has now only to hold the ratchets out of gear with the ratchet wheel, when the weight K, acting on the shaft *d*, will screw back the nut, and so be ready to fill another pin bobbin.

The way the ratchet *b*, is made to cease its action upon the ratchet wheel when any breakage of thread or threads occur, or when any of the bobbins that are being wound from run empty, is as follows:—When any of the detective levers M, (fig. 1) fall upon the lever O, the curved arm *p*, will fall into the position shown at *x*. It will be seen, that when the traverse rod moves in the direction shown by the arrow, this arm will strike the ratchet *b*, causing it to move upon its centre, and fall over, resting upon the part *y*; this so raises its point *b*, that it will pass over the ratchet wheel without touching it, and no motion will be given to the shaft *d*, until such breakage is made good or the empty bobbin replaced; when this is done, the detective levers being supported by the thread, the lever will resume its first position, and the ratchet will rotate the wheel as before.

The patentees claim, "the general construction and combination of mechanical parts for winding one or more threads on the pin bobbins used in small ware and ribbon looms, that is, all such pin bobbins as rotate when in the shuttle, the rotation being caused by the thread or threads as they are drawn off or unwound from the pin bobbins when weaving, substantially in the manner described."

To WILLIAM ROWAN, *of Belfast, for improvements in machines for heckling and scutching flax and other vegetable fibres.*—[Dated 27th November, 1861.]

THIS invention consists in fixing to the ends of the beaters and of the bars which carry the pins for heckling, and the beaters or combs for scutching, spindles or trunnions; which spindles are received in bearings fixed on the circular frame, cylinder, or drum of the machine. The invention also consists in fixing adjustable guards in front of the heckle pins, when the machine is used for heckling, in order that the depth to which the pins enter the fibre may be regulated according to the nature thereof. While play is allowed to the beaters and heckle or comb bars, they are prevented from revolving.

In Plate III., fig. 1 shows in vertical section, and fig. 2 in end view, so much of a drum, fitted with a beater and heckle or comb bar as will be necessary to illustrate the manner in which the invention is carried into effect. *a*, is the periphery of the drum; *b*, is the beater; and *c*, is the heckle or comb bar: *d*, *d*, are the spindles or trunnions on the ends of the bars, and resting in bearings *e*, *e*, bolted or otherwise secured to the drum; *f*, is the guard in front of the heckle pins or teeth, inserted in the drum *a*, and fitted in such manner that its height may be adjusted to regulate the depth the pins or teeth enter the fibre. When the machine is used for heckling, the heckle bars are arranged round the periphery of the drum, cylinder, or circular frame alternately, or otherwise, with the beaters.

The patentee claims, "First,—constructing the beaters and bars which carry the pins for heckling, and the beaters or combs for scutching with spindles or trunnions, which are received in bearings in manner and for the purpose described. And, Second,—the employment of adjustable guards, as described."

To ROBERT KENNEDY *and* JAMES ARMSTRONG, *both of Lisburn Ireland, for an improved arrangement of driving gear.*—[Dated 4th December, 1861.]

THE object of this invention is to prevent what is known to engineers as "back lash," which is a movement creating great wear and tear in bevil and spur gearing. To remedy this inconvenience, the patentees apply fast pulleys to the spindles of the bevil or spur gearing, around which run driving straps that pass from one pulley to another; by this means a series of spindles and gearing may be bound together, and effectually prevented from overrunning, which is the principal cause of back lash.

When adapting the invention to millstones driven by the ordinary kind of gearing, a belt is passed from a pulley on the spindle of the first driven pair over a double pulley on the spindle of the second pair, and in like manner the spindles of all the remaining stones are coupled. A strap is carried to a pulley on an upright shaft or other gearing, on which (if necessary) a fly wheel to balance motion is mounted.

In fig. 1, Plate IV., A, is a large spur driving wheel, mounted on the driving shaft B, and into which gear the two driven wheels C, and D. On the respective axles of these wheels are two pulleys, C^1, and D^1, round which passes the driving band E, whereby the two pulleys are made to run together. One of the pulleys being slightly larger than the other, the

effect of the combination shown will be that the teeth of the driven wheels will be kept in contact with the teeth of the driver, and there will be no back lash.

Fig. 2 is an elevation representing the invention as adapted to mill gearing. On the axle or shaft D, are mounted the bevil tooth wheels F, F^1, whereby the runners of the mills are actuated. In order to drive these latter at uniform speed, and prevent back lash, a pair of pulleys H, H, and H^1, H^1, are mounted on the vertical shafts or spindles of the runners. A band *i*, which passes round a pulley at I^1, on the shaft D, and over a guide pulley J, and round one of the pulleys H, assists in driving the runner of the mill. Another band from the other pulley H, passes round one of the pulleys H^1, on the spindle of the runner of the other mill, and assists in driving the same. By means of these bands and pulleys all back lash throughout the train of wheels to which they are applied is prevented.

The patentees claim, "the adaptation to toothed gearing of pulleys and bands, for the purpose of preventing back lash, as herein set forth."

To RICHARD ARCHIBALD BROOMAN, *of Fleet-street, for improvements in apparatuses for letting off water from, and for admitting oil or other lubricating matter into, steam cylinders,—being a communication.*— [Dated 25th September, 1861.]

THE apparatus for allowing water to escape from steam cylinders is composed of a tube, screwed on to the cylinder, opening through another tube into a spherical or other suitably shaped chamber, in the bottom of which is a valve, in the form of a plunger, kept in position to allow of the outlet of water by a spring; the top of the valve is in the form of a cup, in which the tube communicating with the cylinder dips.

In Plate IV., fig. 1 is a vertical section of this apparatus for letting-off water from steam cylinders; and fig. 2 is a horizontal section, through the line A, B, of fig. 1. *a*, is the chamber, made with a screw *b*, at top, for attaching it to a steam cylinder; *c*, is an aperture, into which the tube *d*, is screwed, extending to near the bottom of the chamber *a*; *e*, is a stopper screwing into the bottom of the chamber; *f*, is a valve in the stopper, the upper end of which is capped, and into which the tube *d*, dips. The valve rod is made, by preference, triangular, so that, except when the cup rests, or is pressed by the steam on its seat, there are passages between it and the stopper *e*, leading to the atmosphere, as shown in fig. 2. *i*, is a spring in the valve *f*, connected to a rod *h*, which latter is connected to a cross bar, supported by a flange *j*, formed on the lower part of the stopper *e*. An apparatus of this description is, by preference, placed at each end of the cylinder, in order that water may be effectually withdrawn from both sides of the piston. The action is as follows:—The valve *f*, is open until the admission of steam on one side or other of the piston, as the case may be, issuing through the tube *d*, and pressing on the cup, closes the valve, and keeps it closed until the commencement of the return stroke, when any water which may have become condensed, escapes, and so on.

The apparatus for admitting lubricating matter consists of a cup closed at bottom by a screw valve, and communicating, when the valve is opened, with a chamber, into which two tubes lead from the cylinder;

one of these tubes, curved upwards, is of larger bore than the other, which is curved downwards, and nearly touches the bottom of the chamber.

Fig. 3 is a view, in sectional elevation, of this apparatus. *l*, is the cup, with the valve *m*, at bottom; *n*, is the chamber. The valve is kept closed by a screw *o*, turned by a key *p*. *q*, *r*, are tubes in the chamber *n*; the tube *q*, is about twice the diameter of the tube *r*. *s*, is a lateral continuation of the chamber *n*, which terminates in a screw *t*, by which it is connected to the cylinder. The working of the apparatus is as follows:—The cup *l*, is filled with oil, and the screw valve *m*, opened, which allows of the contents entering the chamber *n*; the valve *m*, is then screwed down. On steam being admitted above the piston, a portion enters the chamber by the tube *q*, and, pressing upon the oil, forces it through the smaller bored tube *r*, into the cylinder.

The apparatuses just described may be combined and fitted to steam cylinders, as shown in fig. 4, where the letters of reference correspond with those used to denote the various parts in the previous figures, in so far as those parts are seen; or each apparatus may be used separately.

The patentee claims, "First,—the apparatus for letting off water from steam cylinders, constructed and acting substantially in manner hereinbefore described with reference to figs. 1 and 2. Second,—the apparatus for admitting oil or other lubricating matter into steam cylinders, constructed and acting substantially in manner hereinbefore described with reference to fig. 3."

To John Standfield, *of Stratford, for improvements in apparatus for regulating and indicating the speed of steam engines and other machinery.*—[Dated 27th November, 1861.]

This invention consists, firstly, in apparatus for indicating the number of revolutions or speed of the machinery to which it is attached, and at the same time giving motion to, or regulating, the valve or apparatus through which the steam or other fluid is supplied to the cylinder or machine to be regulated; the construction of which valve forms the second part of the invention.

In Plate III., figs, 1, 2, and 3 show three modifications of the apparatus. A, is a cylindrical case, containing water; this case is made stationary in the arrangements shown at figs. 1 and 2, and rotating in that shown at fig. 3. B, are arms attached directly to the said case, or cast separately, as in figs. 2 and 3; C, is the vertical spindle, with its arms D; E, are receptacles for an excess of fluid, which may always be maintained by means of a head of water acting through a tube, if desired; F, are pulleys for giving motion to the apparatus; this may be done also by toothed bands or wheels. In fig. 1, the motion is communicated from the pulley F, to the bevil wheels G, H, and to the frame J, and spindle I, by means of the cross bar K. When revolving at their proper speed, the whole of these parts revolve together and at the same speed; but should the pulley F, alter its velocity, the wheel H, is not immediately affected so as to carry it and its attachments at the same or altered speeds of F, and G, but tends to revolve on its axis L, which causes the small pulley upon it to wind up the cord M, and raise the cross bar K, and spindle I, and so operate upon the lever N, and regulating valve lever O. When this action shall take

place is determined by the actual velocity given to the pulley F, and the position of the weight P, on the lever N. Q, is a glass tube, with scale for indicating the number of revolutions by the pressure or height of water raised in the said tube. Fig. 1 also shows the equilibrium throttle valve; the valve discs being united together by a spindle, in which is a slot or other arrangement for the lever R: this lever is worked by another lever O, outside the casing, the spindle S, going through the said casing. By this arrangement the area of the valve discs are not rendered unequal by any spindle passing completely through either of them for the purpose of working them.

In fig. 2, the motion of the pulley F, gives motion to the frame containing the fans or blades B; the spindle C, and blades D, being stationary so long as the pulley F, does not alter its intended speed. When this speed is exceeded or lessened, however, the blades D, and spindle C, are forced round, and, through the spring balance G, act upon the lever H, and throttle valve attached to it. I, is a watch-spring arrangement, with wheel and pawl, for bringing the tension of the spring balance up to any extent required; and J, is a pressure gauge for showing the speeds. By the motion of the spindle C, the cord or chain K, is wound round the spindle, or a pulley or barrel attached to it.

In fig. 3, the action is precisely the same as in fig. 2, only the adjustment of the apparatus is made by a sliding weight I, on the lever J.

Fig. 4 shows the application of the apparatus as an indicator of speed only to a locomotive engine. A, is the driving wheel; B, a friction wheel, fixed on a rod jointed at D, so as to allow for the action of the springs of the wheel A; C, is the cylindrical casing and fans, as before described, shown in a horizontal position; the index hand being to the spindle, and the casing having a face with figures marked thereon for showing the speeds. Motion is communicated by the cord E, or by any other convenient means.

The patentee claims, "First,—the general construction of apparatus for regulating, and at the same time indicating, the speed of engines or machinery, as described, or by equivalent arrangements. Second,—the method of transmitting motion generally from a fan, or series of fans, or other apparatus, to water or other fluids, and thence to a second fan, series of fans, or apparatus, as described. Third,—the method of retarding the rotation of fluids in vessels, or of fans or blades in fluids, by means of a second set of fans or blades, or equivalent apparatus, as described. Fourth,—the use of part of the apparatus described for indicating the speed of locomotive or other engines or machinery without regulating the said speed, as described. Fifth,—the general construction of equilibrium valves, to be worked as throttle, and in which the equality of pressure on the two valves is maintained by arranging the working spindles and levers as described, or by other equivalent means.

To CHARLES FREDERICK HAYES, *of the Royal Small Arms Factory, Enfield, for improvements in means or apparatus of generating steam.* —[Dated 5th November, 1861.]

THE object of this invention is to obtain a very rapid generation of steam. For this purpose a metal pipe of small diameter, subjected to the

direct action of the heat of the furnace, is employed as the steam generator. Water, in very small quantities, is passed into the heated part of the pipe, and is immediately converted into steam, which, by a valve or other passage, passes into another pipe (or an extension of the piping), laid in coils, or otherwise, in a superheating or surcharging chamber, and there this pipe terminates in a rose head, or other means adapted to finely distribute the steam in this chamber for the ready conversion of it there into high-pressure steam.

In Plate III., fig. 1 shows a transverse section, and fig. 2 a longitudinal section, of the improved apparatus for generating steam. *a*, is the fireplace; *b*, the piping for receiving the water to be converted into steam, and which water is supplied from a suitable reservoir by means of a pump *c*. By the heat of the fire generated in the fireplace *a*, the pipe *b*, becomes highly heated—heating first the part b^1, which is over the fire, but sufficiently above the intense heat thereof to prevent injury to such piping. This piping, by preference, is laid in a coiled or serpentine form, as shown, and it is also, by preference, made up of short lengths, having right and left-hand threads, connected by sockets b^2, b^2. The water, as it is forced in small quantities, by the pump, into the heated part b^1, of the pipe *b*, is instantly converted into steam, which then passes, with increasing velocity, from this part of the pipe through the whole length thereof, becoming surcharged in its course. The steam generated in the part of the pipe which is over the furnace thence passes through the induction valve *d*, into the next length of piping b^3, which is also laid in a serpentine, or it may be in a coiled, figure, within and at the bottom of the surcharging or superheating chamber *e*; after traversing this part b^3, of the pipe, the steam is allowed to escape from the pipe b^3, into the chamber *e*, through a rose head *f*. This chamber or cylinder *e*, is so formed, that the whole surface thereof may, as much as possible, be subject to the direct action of the heat of the fire and of the heated products of combustion passing therefrom. *o*, is a chimney for the escape of the products of combustion. The other sides of the flues are formed by the outer casing or jacket *g*, *g*, which acts with the chamber *e*, as a receiver for the surcharged steam. The chamber *g*, is covered with a non-conductor of heat, for the purpose of preventing the radiation of heat therefrom. The communications between the chamber *c*, and the chamber *g*, are made by very strong hollow stays *h*, *h*, screwed into the plates of each chamber. These stays not only answer as passages for communication between the two chambers, but are a great assistance in connecting them. There are also other stay connections *i*, *i*, made by wrought iron brackets. The part of the jacket exposed to the greatest amount of heat from the fire is protected with fire bricks, as shown at *j*, *j*.

The patentee claims, "the adaptation or combination of means for generating steam substantially as explained."

To George Parry, *of Ebbw Vale Iron Works, Monmouthshire, for improvements in the manufacture of iron and steel.*—[Dated 18th November, 1861.]

This invention has for its object the production of a superior bar or wrought iron to that obtained in the ordinary manufacture of iron, as well

as the production of cast steel, in large masses, of a superior quality to that obtained by the direct decarbonization of crude pig iron, as now carried out. To accomplish these objects, the patentee takes wrought iron, which, from having previously undergone the puddling process, has been purified by the expulsion of sulphur and phosphorus, or wrought iron scrap, and introduces it, together with coke or other fuel and proper fluxes, into a blast furnace, similar in form to that ordinarily used for melting pig iron, but so arranged, with respect to the tuyeres, as to ensure the maintainance of a much higher temperature in the furnace than is required for merely melting the iron. By this means, the rapid and economical carbonization of the wrought iron under treatment is effected. When thus carburetted, the iron is run out from the converting or blast furnace into any suitable form, and submitted to the puddling process, by which means a further portion of sulphur and phosphorus is removed, and the iron is increased in strength and value.

In Plate III., fig. 1 shows, in partial vertical section, the furnace employed for converting or carbonizing wrought iron. A, A, are the furnace walls; B, is a tuyere blowing horizontally; C, a smaller tuyere, inclined downwards at an angle of about 30° to 45°; D, D, are tuyeres placed near the bottom of the furnace, for blowing air through the metal when required (two of which only are shown); E, E, are blast boxes, for supplying the tuyeres D, D, and which are connected with the blowing engines by pipes F, F.

In carbonizing the wrought iron, it is proposed to make it take up two per cent., or thereabouts, of carbon from the coke, when it will be ready to undergo the subsequent treatment of puddling, which will convert it into what is termed by the patentee "purified wrought iron." Sufficient fuel having been supplied to the furnace for the purpose of getting up the heat, the furnace is charged with about 7 cwt. of coke (with sufficient lime to flux the ash of the coke) to every ton of wrought iron, the materials being applied in successive quantities of from $1\frac{1}{4}$ cwt. to $1\frac{1}{2}$ cwt. of coke to 4 cwt. of iron, which will be found a convenient quantity for each charge. The converting furnace being filled, and the blast put on, the furnace should be kept nearly full during the continuance of the operation, or the iron will not have taken up a sufficient dose of carbon, and unless this be done, the subsequent treatment of the iron in the puddling furnace will be useless; the presence of a certain amount of carbon in combination with the metal being necessary to produce the "boil," without which no efficient refining of the iron will take place. With a small furnace, $2\frac{1}{2}$ feet square, rounded at the angles, and from 10 to 15 feet high, blown by one horizontal tuyere, having a nozzle of $2\frac{1}{2}$ inches diameter, and one inclined tuyere of $1\frac{1}{4}$ inch diameter, with a pressure of blast of $2\frac{1}{2}$ to 3 lbs. on the square inch, about one ton of iron may be carbonized and run out per hour. In carrying out this part of the process, it is preferred to blow down into the iron through one or more tuyeres C, not using the lower tuyeres D, D. G, is the cinder-hole at the back of the furnace, and H, the tap-hole.

When the charge of scrap or puddled iron has been subjected to the blast a sufficient time to bring down, say, a ton of the carbonized metal, the furnace is tapped, and the metal is run into moulds, as is usually done with pig iron intended for puddling, and it is otherwise treated in a similar manner to iron prepared for puddling; that is to say, the carbon-

similar manner to iron prepared for puddling; that is to say, the carbonized, wrought, or scrap iron is submitted to the operation of puddling in an ordinary puddling furnace, and by that means it is caused to part with the impurities remaining therein after the first puddling process. The metal is removed as puddled balls, which may then be submitted to the ordinary rolls, for the purpose of being reduced to the form of merchant or other bars. This completes, in general, the process of making "purified wrought iron," which may be subsequently converted into cast steel in the manner presently to be described, or applied to other uses. When, however, a still purer quality of iron is required, the converting or carbonizing process is repeated, and the metal is then subjected to the puddling process as before.

The patentee remarks that, by taking the thoroughly puddled iron from the furnace in small balls or pieces, the cost of rolling the same into bars, and cutting those bars up by shears into pieces suitable for undergoing a second carbonization, or for conversion into hard or soft steel, will be avoided. The pieces of wrought iron intended for carburation should not be too large—not much exceeding the size of a railway bar cut up into lengths of 4 to 6 inches. Cinder iron, of which nearly the whole of the railway bars laid down have been manufactured, becomes, by sufficient carburation in the converting furnace, and subsequent puddling, equal in value to the best brands of mine iron, and may be used for the like purposes, or be converted into cast steel: thus the iron rails now in use, as they successively become worn out, may, by this invention, be converted into durable cast steel rails.

In order to convert bar or scrap iron into cast steel, a smaller proportion of coke or fuel is introduced into the converting or blast furnace than is required for manufacturing the purified wrought iron. The proportion may be so regulated, as to communicate to the wrought iron the desired degree of carbon known to exist in the various classes of cast steel, from hard cast steel to soft cast steel, and this steel is run out of the furnace into ingots, or into any desired forms.

In the manufacture of cast steel from wrought iron, the same kind of converting furnace is used as that described for making the more highly carburetted metal; but the quantity of coke is reduced to about 5 cwt. to every ton of wrought iron used when making a hard steel, and to about 4½ cwts. when producing a soft steel—the proportions varying somewhat according to the quality of the coke or other fuel used. In making hard steel, it is preferred to use the tuyeres B, C, (fig. 1) without using the tuyeres D, D; but the size of the nozzle of the blowing down tuyere C, is increased, making it about 1½ to 1¾ inches in diameter, so as to discharge more blast into the metal at the bottom of the furnace than is required when preparing the carburetted iron for the puddling process. The proper quantity of air required will be found by a little practice; for if too little be blown down, the steel will be found deficient in fluidity.

In making soft cast steel, two or more of the tuyeres D, D, together with the ordinary tuyere B, of the blast furnace, are used with or without the tuyere C. The tuyeres D, D, being below the surface of the fluid converted wrought iron or molten steel, must be supplied with blast of sufficient pressure to force through the head of metal, and it is found that 3 lbs. to the square inch is enough for every 6 inches of depth of metal. The state of the metal in the bottom of the furnace may be partly judged

of by passing a small rod of iron into it, through the tuyere C, or more exactly by tapping out a small quantity of it. If too hard, the blast should be slackened on the tuyere B, the blast on the other tuyeres being either continued unaltered or somewhat increased. If found too soft, a portion of hard steel or any pure pig or carburetted iron may be run into it through the tuyere C, where also any manganesic or other desirable alloy may be passed in, by moving the blow-pipe back, just previously to tapping the furnace. It is best not to run the steel direct from the furnace into the moulds, but first into a funnel, from whence it may be passed out with greater regularity on removing the funnel stopper, as is usually done when large castings of steel are made from the accumulated pourings of numerous crucibles.

Instead of making soft steel in the converting furnace, as just described, it is preferred to produce it at two operations. Thus, a hard steel is made first in the converting furnace, and then run out into another furnace or receiver, where it is reduced to the required degree of softness by passing air through the fluid metal from below, as first pointed out in the specification of Mr. J. G. Martien's patent, 15th September, 1855,* for the treatment of crude pig iron; or air is blown down on the surface of the metal, as practised in the old refineries; and should the steel now be found too soft for the purpose required, it is hardened by the addition thereto of a proper proportion of the hard steel in a fluid state from the converting furnace.

Fig. 2 represents, in sectional elevation, the furnace or receiver into which the hard steel is run from the converting furnace. E, E, are two blast boxes, of which there are several placed round the furnace: they are made either cylindrical to hold but one tuyere each, or are widened out around the furnace so as to hold a greater number. G, G, is the main blast pipe, which passes round the furnace and feeds the blast boxes by the pipes F, F; D, D, are two of the tuyeres for blowing air through the molten metal; and H, the tap-hole for discharging it when reduced to the required degree of softness. This furnace or receiver may be made of two truncated cones of sheet iron, joined at the base—or better of a curved or parabolic form, as shown in the figure—and lined with fire-resisting material, which is shown at I, I, I. The charge of hard steel, or carburetted wrought iron is run in a molten state, into the furnace through the opening J, at the top, after the blast has been turned on.

The furnace may conveniently be heated by means of a gas blow pipe, shown in vertical section, at fig. 3. A, is the fuel chamber of this blow pipe, charged up to the line D, with breeze or small cokes, cinders, or refuse from the fires, together with a portion of lime to flux the clinker and ash, and which runs out at the cinder-hole C. B, is a blast pipe for generating the gas, and H, another for effecting the combustion of the gases while passing through the pipe I, to the furnace, fig. 2; or the blast of air, for consuming the gases, may be introduced at the hole K, directly into the pipe I. This gas furnace is lined with fire-brick, and closed by a brick cover L, or it may be surmounted by a charging hopper. The pipe I, is also lined with loam or other bad conductor of heat. This gas blow pipe is mounted on wheels, for the convenience of removing it from the furnace, fig. 2, when desired. After a few minutes' blowing into the

* For report of this specification see Vol. iv., p. 210 (New Series).

the workman after a little experience—the steel will have become sufficiently softened, and may be tapped and run out into a funnel, and dealt with as before described. Previously to tapping the furnace, alloys may be run in at the top J, or, what is better, the alloying material may be poured into the funnel as the steel is running. It may also be hardened, when made too soft, by the addition of hard steel, or of any pure pig or carburetted iron, which may also contain the alloy, in the same manner.

In the manufacture of cast steel direct from crude pig iron, as lately introduced, by removing a portion of the carbon, sulphur and phosphorus remain behind, and it is difficult to get crude pig iron free from these injurious elements. In this process for manufacturing cast steel by adding carbon to wrought iron, which had previously been puddled, nearly all the pig iron produced in this country becomes available for the manufacture of cast steel in the converting furnace, the greater proportion of the sulphur and phosphorus originally contained in the iron having previously been eliminated in the puddling process.

When that kind of wrought iron called puddled steel is used in the converting furnace, for conversion into cast steel, the proportion of fuel expended will be less than that given above. The same remark also applies when hot blasts are employed; in the latter case, the tuyeres, which are placed above the surface of the metal, may be of the kind well known as "water tuyeres," but with cold blasts brick or refractory firestone tuyeres are best. The tuyeres placed below the surface of the metal are conveniently made of very thin sheet iron, "black plate," slightly tapering, having good fire sand, or clay, rammed around them. The best materials for these purposes are the more siliceous underclays of the coal measures, or as small a proportion as possible of the fat or aluminous clays, mixed with powdered white sandstone, as well as for the lining of the furnaces.

The patentee claims, "the process above described, whereby he is enabled to produce purified wrought iron, and hard or soft cast steel, in large masses, in an economical manner."

To JOHN HENRY JOHNSON, *of Lincoln's Inn Fields, for improvements in toothed wheels, and in the apparatus used in their manufacture,—being a communication.*—[Dated 23rd November, 1861.]

THIS invention relates to a peculiar manufacture of toothed wheels and pinions, and consists in moulding such gearing from sheet india-rubber in suitable moulds, the moulded wheel or pinion being afterwards hardened, by submitting the article, whilst in the mould, to the action of heat.

In Plate III., fig. 1 represents an elevation of a spindle of a spinning frame, to which is applied one of the improved pinions; fig. 2 is a vertical section of the pinion detached; and figs. 3 and 4 represent respectively, in side elevation and vertical section, the mould adopted in making toothed wheels according to this invention. *a*, is the central spindle or core of the mould, which forms the opening in the boss of the wheel or pinion. It is enlarged at its lower part *b*, which is made convex on its upper surface, so as to leave a hollow or cup in one end of the boss of the pinion at *b* (see fig. 2). *c*, is a ring or collar, which fits accurately the

enlarged shoulder *b*, on the spindle or core *a*, and forms the outer surface of the boss of the wheel or pinion. *e*, is a ring fitted accurately on to the top of the collar *c*, and having a number of teeth formed on its inner surface, such teeth corresponding in size and number with the spaces between the teeth to be moulded in the wheel or pinion. On the top of this last mentioned ring is fitted the cap *f*. The mould is thus composed of four parts, which are all held firmly together by being placed inside a frame *g*, and are then tightened up by driving in a key or wedge *k*, between the cap *f*, and the top of the frame, as shown clearly in fig. 4. By this means the requisite pressure is obtained for forcing the prepared caoutchouc into the cavities of the mould, thus producing an exact counterpart thereof. The mould, with the caoutchouc contained therein, is then submitted to the desired temperature for hardening the caoutchouc, after which operation the mould is opened and the wheel or pinion withdrawn, for the purpose of removing any roughness or asperities from its surface. A thin metal bush *k*, (fig. 2) is now inserted firmly into the boss of the finished wheel or pinion, a small flange *l*, being left at one end of the bush to maintain it in its place—such flange resting on the face of the wheel or pinion.

The pinion, thus manufactured, is mounted upon its spindle in the manner shown in fig. 1; the pinion being forced against a shoulder *n*, on the spindle, by the action of a helical spring *m*; the shoulder entering the concavity *b*, in the upper end of the boss of the pinion. The pinion gears with another pinion also made of hardened india-rubber, and actuated by the machine so as to transmit the requisite rotatory motion to the spindle. Above the shoulder *n*, is fitted the wheel n^1, suitably secured to the spindle. It is obvious that wheels and pinions of all sizes and shapes may be manufactured according to this invention, and adapted with advantage to various kinds of machinery.

The patentee claims, "First,—the system or mode of manufacturing toothed wheels as described. Second,—the general construction and arrangement of moulds for manufacturing toothed wheels of hardened india-rubber, as described. Third,—the application of metallic bushes or linings to the bosses of toothed wheels manufactured of hardened india-rubber as described. Fourth,—the peculiar application of pinions composed of hardened india-rubber, and provided with metallic bushes, to the spindles of spinning machines, as described."

To WATSON DUCHEMIN, *of Charlottetown, Prince Edward's Island, for improvements in blocks for hoisting.*—[Dated 3rd December, 1861.]

THIS invention relates to improvements in that class of hoisting blocks in which friction rolls are introduced, and consists, firstly, in a block having a ring or central bearing of considerable diameter cast on to, or otherwise suitably attached to, the shell of the block, and surrounded by a loose metal ring (which serves the purpose of the sheave of an ordinary block), and between which and the central bearing is interposed a series of friction rolls on which the loose ring turns. Secondly, in improvements in metal bushings for sheaves of blocks; the same consisting of a loose ring or sleeve surrounding the axle on which the sheave runs, a series of friction rolls, and a box for containing the same.

In Plate IV., fig. 1 is a plan of a block, one side of the shell being removed; fig. 2 is a section of the same; fig. 3 shows details to be hereafter referred to; fig. 4 is a plan of a block, with part of the shell removed, showing the improved bushing for the sheaves of blocks; and fig. 5 is a section through the middle of the block. Fig. 1 represents a block (made of brass or malleable iron), the shell of which is divided into two halves A, A², which are held together by bolts *a*, and nuts *b*. The block is furnished at one end with a hook *c*, and at the other with an eye or becket *d*; these are formed on the half A², of the shell, the cap plate A, being of less thickness at its ends where the bolts *a*, pass through it. Both parts have a circular opening B, through the centre. From the inner face of the piece A², rises a stout ring *e*, the outer edge 3, of which is embraced by the cap plate A. There is formed in the face of each plate A, A², grooves *f*, *g*, exterior to the ring *e*, forming rings 4, 5, 6, 7, which project up from the face of each plate. A heavy ring C, is placed between the two plates A, A²; it is turned out at *h*, to receive the rope, like an ordinary sheave, and has a rib *l*, on its inner side, which fits between the rings 4, and 5; this ring C, is of a somewhat larger diameter than the rings 4, and 5, and revolves freely outside of them. Between the ring C, and the stationary ring *e*, are placed friction rolls *m*, of larger diameter than the width of the grooves *f* and *g*, so that they rest on the rings 4, 5, and 6, 7, and fill the space between the rings C, and *e*,—the loose ring C, rolling around on these friction rolls. To prevent these rolls *m*, from running in contact with each other, and grinding together, another series of rolls *o*, of less diameter, but of greater length, is introduced, one between each roll *m*; these rolls *o*, lie in the grooves *f*, and *g*, and revolve freely therein. Instead of the small rolls *o*, blocks *p*, are sometimes employed, as shown at fig. 3, which are curved out on each side to fit the rolls *m*, and are introduced between the rolls *m*, to keep them separate, but are not intended to receive the bearing of the ring C, unless a weight should be applied to the ring sufficient to crush the rolls *m*, or to indent them into the ring. Before, however, this can take place to any considerable degree, the ring C, will be supported by the blocks *p*, (when these are used as in fig. 3) or by the rings 4, and 5. Any required degree of strength may be given to the ring *e*, whilst the form of the shell with the opening B, in the centre allows the block to be made light in proportion to its power and strength; or in some cases, where lightness is not so much an object, the shell may be made whole, that is, without the opening B, and, instead of the ring *e*, a solid disc may occupy the centre of the block, and serve as a bearing for the friction rolls *m*.

In fig. 4, A¹, represents a wooden block; B¹, the strap; C¹, the wooden sheave, in the centre of which is inserted a metal bushing D¹, of the following construction:—The box a^1, of brass or other suitable metal, is let into the sheave, and is secured in place by screws c^1, or by rivets passing through its rim. A cap b^1, closes the other side of the box; it rests on a shoulder 3, on the inside of the box, and is secured by pins or screws passing through the side of the box into the edge of the cap. E¹, is the pin or axle on which the sheave revolves; it passes through, and fits in, the strap B¹, and is secured by a nut f^1. A sleeve g^1, is introduced into the bushing D¹, through which the pin E¹, passes, and which turns freely on this pin; it is turned down at each end, where it passes through the face of the box a^1, and through the cap b^1, leaving a larger portion 4, in its

middle, which prevents its working out endwise. Between the sleeve g^1, and the box a^1, is introduced a series of friction rolls h^1, on which the sleeve rolls, and a series of blocks i^1, (fig. 4) one of which is placed between each roll h^1, to keep them apart and prevent them grinding one on the other. These blocks are of the same length as the rolls, but their depth is rather less than the diameter of the rolls, so that the sleeve shall bear on the rolls. The circle of friction rolls is thus increased in size by the thickness of the sleeve, which causes the rolls to operate more freely than they would in a smaller circle; and if, from any great or sudden strain, the rolls should be crushed and cease to operate, the pin E^1, will turn freely in the sleeve g^1, and the block will be as efficient, and run as easily, as an ordinary block. This construction of bushing also has another advantage, that when a weight is suspended on the block, the axle or pin E^1, cannot lie between any two of the rolls h^1, and force them apart, as is liable to be the case in some other blocks in which friction rolls are used, and in which the pivots of the rolls are often broken in this manner.

The patentee claims, "First,—a hoisting block, having a loose metal ring C, (which takes the place of a sheave), in combination with the central bearing e, and the friction rolls m, operating substantially as specified. Second,—the sleeve g^1, in combination with the box a^1, and friction rolls h^1, substantially as described."

To JAMES COCHRANE, *of Harbern, Mid-Lothian County, for improvements in wet gas meters.*—[Dated 5th December, 1861.]

THIS invention relates to a peculiar arrangement of wet gas meter, whereby the requirements of the Sale of Gas Act may be complied with.

According to this invention, it is proposed to surround the present float of the gas inlet valve by a box or partition, so as to separate it from the ordinary water chamber of the meter, and to insert the lower end of the water supply pipe into this box or float chamber, in lieu of into the main water chamber as heretofore. By this means, the smallest quantity of water, which may be fraudulently extracted by a syphon or otherwise through the water supply pipe, will instantly affect the position of the float, and cause the gas to be shut off without affecting the proper water level in the measuring chamber.

The figure in Plate IV. represent a front elevation of the improved wet gas meter, with the front plate removed, to show the improvements. A, is the outer casing of the meter; B, the gas inlet valve, on the spindle C, of which is fitted, in the usual manner, the float D (shown in the highest and lowest positions). E, is a box, or open vessel, formed within the front chamber of the meter, and entirely surrounding the float D, which it separates from the main water chamber F. F^1, F^1, are two guides attached to the rod E^1, and serving to guide the spindle of the valve and float; G, is the water supply pipe, which communicates directly at its lower end with the float box E. The remaining portions of the meter are of the ordinary well-known construction. On supplying this meter with water, the cap H, is unscrewed, and the water poured down the water supply pipe into the float box E, whence it flows over the edge of the partition H^1, thereof into the water chamber F, till it obtains the proper level therein. These improvements may be readily applied to old wet gas meters by

simply inserting therein a small box for containing the float D, so as to form a separate chamber or compartment. If preferred, the lower end of the water supply pipe may be bent so as to enter the float box at one side near the bottom thereof, in place of dipping vertically and directly therein. If desired, a small aperture of from $\frac{1}{30}$th to $\frac{1}{40}$th of an inch diameter may be made at *a*, in the side of the chamber or box E, about one inch below the proper water level, so as to connect this chamber or box with the main water chamber F. By this means, the water level in the chambers E, and F, if lowered by evaporation or otherwise, will very slowly adjust itself. I, is the overflow pipe, which opens at its lower end into the waste water box K; and L, is the plug for drawing off the overflow.

The patentee claims, "First,—the general construction and arrangement of wet gas meters as hereinbefore described. Second,—the enclosing of the float of the gas inlet valve in a special chamber or box which is separate and distinct from the main water chamber of the meter, and the introduction of the lower end of the water supply pipe into such special chamber or box, for the purpose described."

To PHILIP JEWELL, *of Brighton, for improvements in concertinas.*—[Dated 29th August, 1861.]

It is well known that in German concertinas each stud, according as it is acted upon by the finger of the player, in one of two modes, is capable of sounding one or other of two natural notes, and it is customary to employ two rows of such studs, with suitable mechanism, to be acted on thereby, at each end of a German concertina, though, in some instruments, more than two rows of studs are used; and although apparatus for sounding the semi-tones of the chromatic scales have been applied to other constructions of concertinas, it has not been usual to apply mechanism to German concertinas, to enable the semi-tones of the chromatic scales, as well as the natural notes, to be sounded thereby. Now part of this invention consists in applying an additional row of studs at each end of a German concertina, in combination with suitable mechanism for sounding the semi-tones of the chromatic scales; each stud of such additional row being arranged in such manner, that it will, when suitably acted on, sound one or other of two semi-tones. And another part of this invention consists in applying to German and other concertinas parallel plates of glass, inside of the instruments, opposite, but at a short distance from, the holes or air passages; by which the tones of the instruments will be modified and improved.

In Plate III., figs. 1 and 2 show the two end views of a concertina constructed according to this invention. The instrument is constructed in the ordinary manner, so far as concerns the natural notes, and the keys and mechanism by which those notes are caused to be sounded; these ordinary keys are shown white in the drawing; each key, as is well understood, being arranged by the interposed mechanism to sound either of two natural notes, according to the manner in which that key is acted on by the finger of the person playing the instrument. In addition to the natural notes, there is an extra row of keys at each end of the instrument, in combination with like mechanism to that used for sounding the natural notes, in order that the semi-tones of the chromatic scales may also be

sounded by the instrument. The keys used for the semi-tones are shown black; they are arranged in such manner, that each key, by suitable interposed mechanism, may sound either of two semi-tones, according to the manner in which the key is acted on by the finger of the person playing the instrument. The peculiarity of this part of the invention consists in applying, in German concertinas, keys and mechanism for sounding the semi-tones of the chromatic scales—each key being arranged to act on the mechanism of two semi-tones. Fig. 3 is a transverse section, and fig. 4 an under side view, of one of the ends of a concertina with glass plates applied over the vibrators, and between them and the apertures by which the sound escapes; *a, a,* are two parallel plates of glass: these plates are kept at a short distance from each other, and from the ends of the instrument. The peculiarity of this part of the invention consists in applying the plates of glass *a, a,* at each end of the instrument, as described.

To THOMAS GOULSTON GHISLIN, *of Hatton-garden, for improvements in the treatment or preparation of certain foreign plants or vegetable substances, and in the application of the same to various useful purposes for which horn, shell, whalebone, indurated leather, fish skin, ivory, bone, hard wood, and compounds of india-rubber or gutta-percha have hitherto been employed.*—[Dated 4th October, 1861.]

THIS invention relates to improvements in the treatment of certain plants or marine substances, known to botanists as the *Eiklonia buccinalis, Laminariæ buccinalis, Duvillea utillea, Sarcophycus potatorum* and their allies, and their application to various manufacturing purposes, such as veneering, coating, mounting, and inlaying, applied to wood, metal, glass, papier-maché, or any other material; also to the manufacture of handles for cutlery, surgical instruments, and tools, whips, umbrellas, and parasols; to the manufacture of walking-sticks, and acoustic and musical instruments, boxes, picture and other frames, medallions, book-covers, and a variety of other articles.

In preparing the raw material, the inventor removes all extraneous matters, and then immerses the substance in a hot lye of caustic lime for about three hours, and, on removing it from the lime, steeps it in a bath of sulphuric acid, diluted with about fifty times its weight of water. The substance is next placed in a solution of common soda, after which any mucilage, or dirt, that may adhere externally to the plant is brushed away; and after washing it for a time in pure water, the prepared substance may be removed to the drying room, and, when half dry, it can be shaped into any form desired. By opening out the tubular plant, and laying it flat to dry, under pressure, it will be converted into sheets.

As a modification of the process just described, the plant, after being trimmed, may be steeped in a solution of American potash, then in dilute nitric acid, and afterwards in spirits of naphtha, and when well brushed out in naphtha, it should be left to dry.

After the substance has been prepared in the manner above described, it may be softened, or rendered in some degree plastic, by means of steam, and when in the softened state, it can be moulded into any desired shape; or the material may be steeped, for about an hour and a half, in a hot solution of common soda, and then applied, while hot, to the prepared

frame or moulds, where it should be left to dry; or while on the moulds, it may be steeped for about three hours in a solution of nitrate of lead, and then left to dry. The prepared substance then contracts and adheres to the mould.

Another mode of preparing the material is, after trimming, to steep it for about three hours in hot, slightly alkaline, water. It may then be stamped, embossed, pressed, or pierced, as may be required. When thus shaped, it should be removed from the die press, and hardened, by steeping, for about an hour, in a hot solution of nitrate of lead; and, in some cases, it is afterwards steeped in a hot solution of common alum or in sulphate of alumina.

Another mode consists in steeping the material, after carefully trimming and cleaning it, in a warm and very dilute solution of sulphuric acid; and, after this, in a solution of corrosive sublimate, or in nitrate of lead, or in a hot solution of alum, for about three hours; or, if desired, two or more of these hardening solutions may be used in succession. It may then be left to dry, and subsequently steeped in a solution composed of spirits of wine, methylated spirit, or pyroxilic spirit, twenty parts; linseed oil, twenty parts; rosin, gum, thirsk, or asphaltum, twenty parts; turpentine, ten parts; shellac, five parts; and sandrack, five parts. The saturated substance is then removed to the drying room, and, when dry, is to be softened by steam, and then laid under pressure, between sheets of warm iron, glass, or other material,—care being taken to protect the grain by blankets, flannel, or felt. It should then be left till quite dry and hard, after which it may be cut up and treated as ordinary horn, and converted into scales for knife handles and cutlery purposes. In order to utilize the waste pieces that result from cutting the prepared material into the required form, the substance may be reduced to a gelatinous mass, and used in this state for plastic purposes. To effect this object, the material is to be cut into small pieces, and then boiled, either in an open vessel or in a close vessel, under pressure, in hot water, or water rendered alkaline, until the substance is quite gelatinous. The superfluous liquid is then to be drained off, and the mass is hardened by running it through a solution of nitrate of lead. Sometimes the material may be steamed until reduced to a soft state, and then submitted to the action of a press, in wooden moulds at first, and afterwards to steel dies.

Another method of operating on the substance consists in reducing it to fine powder by grinding, and mixing the powder with a strong solution of glue, adding thereto a portion of alum and powdered rosin, and then amalgamating the whole, till it arrives at the consistence of putty. The pulverized substance is mixed with coal tar, or a solution of bitumen or asphaltum, in any suitable solvent. The mass may then be rolled out and submitted to pressure, in moulds or steel dies, as may be desired. The articles, when made of a mixture of coal tar or asphaltum, should be submitted to a baking process, at from 300° to 500° of temperature, whereby the articles will be hardened. This latter composition, when moulded, has the appearance of carved wood, and, when dry, it should be brushed over with oil, and polished by friction.

The inventor also proposes to extract the coloring matter from the substance, and to give it the appearance of ivory, by submitting it to the action, first, of a warm solution of soda; second, of sulphurous acid; third, of chloride of lime; and fourth if required, of chlorine dissolved

in water, or in the form of gas. The bleaching operation may be repeated, until a pure white is obtained, and then dyes—such as picric acid, mauve, magenta, and other dyes—may be applied, and various colors thereby imparted to the substance. To produce a variegated brown, so desirable in imitating horn, the external surface of the natural protuberances of the substance should be rubbed off with fine emery paper, and a varnish, composed of shellac, dissolved in methylated spirit, should be applied.

The patentee claims, "the application to various purposes in the arts, as herein set forth, of the marine plants above mentioned, and generally all those plants known by botanists under the generic name of *Laminariæ*. Also, the modes herein set forth of treating or preparing such plants for the several purposes herein set forth, or other analogous purposes."

To WILLIAM SMITH, *of Leek, Staffordshire, for improvements in the preservation of stone, brick, and other such materials used in building; applicable also to the waterproofing of walls.*—[Dated 26th October, 1861.]

IN carrying out this invention, the patentee takes flint or other such silicious substance, and reduces it to a fine powder by calcination and grinding (if prepared after the manner of that used in the pottery trade, it will be suitable for the purpose), and to this alum or sulphate of alumina, reduced to a fine powder, is added; the composition thus formed is made into a paint, by the addition of a suitable vehicle, for which purpose dissolved glue, bituminous substances, or linseed oil and turpentine are used. The composition thus formed may be applied as a paint to stone, brick, or other material used in building, and will be found a protection against decay or damp. The invention, therefore, is applicable to walls of any description which it is desired to render waterproof. The proportions of the materials above mentioned may be varied; but it is found that three parts of flint to one of alum or sulphate of alumina, mixed with a sufficient quantity of dissolved glue to make a substance, when hot, rather thinner than ordinary paint, will answer. In order to color this paint, metallic oxides or other pigments may be employed.

The patentee claims, "the use of a mixture of flint or other such silicious substances and alum, or sulphate of alumina, and combining therewith such substances as aforesaid, for making the same into paint."

To WILLIAM MALTBY, *of De Crespigny Park, Camberwell, for improvements in the manufacture of starch and starch gum.*—[Dated 2nd October, 1861.]

THE patentee takes rice and puts it into a vessel, preferably conical or bell-shaped, and having a false perforated bottom or strainer; this vessel is fitted with two outlets—one in or near the bottom, the other in the side near the top—and it is also provided with an inlet pipe near the bottom. With the rice is introduced a dilute alkaline solution, of a strength similar to that usually employed by starch makers, and in such a quantity as to cover the rice. When the solution has remained about the usual time with the rice, it is allowed to run off through the bottom outlet. The rice is then washed with clear water, by running in the latter through the inlet

pipe among the rice until it passes off clear at the outlet near the top. More alkaline solution is then added to the rice, and the operation is repeated until, by adding an acid to a small quantity of the liquor, no precipitate is produced, or the rice does not color the alkaline solution. The liquor is now allowed to run off; after which a solution of alum, or of bisulphate of soda, or potash, or any such earthy or metallic salts, as will produce a white precipitate by the addition of an alkali, is passed through the mass until the starch becomes white and the alkali it contains is neutralized. The rice thus treated is then washed with clear water, dried, and ground, after which it is ready for use.

The next part of the invention relates to means for treating starch, rice flour, or any other such like substance containing starch, in order to render it more soluble and capable of producing a better glaze. From one to four pounds of malt flour or ground malt, or say the husks of malt, with just sufficient water to obtain a solution of the diastase, are combined with about thirty-two pounds (or more or less, according to the material used, and the quality of it) of starch, rice flour, or other starchy substance. After standing some time at an increased temperature, the mass is dried, and when ground it is ready for use. To improve the color, the solution of diastase may be treated with alumina.

The patentee claims, "First,—the form and arrangement of the vessel for treating the rice preparatory to its conversion into starch, in so far as pertains to the position, use, and application of the two outlets and the inlet pipe, substantially as described. Second,—the method and plan of neutralizing the alkali used to treat the said rice by means of a solution of alum, sulphate of magnesia, bisulphate of soda, potash, or such other earthy or metallic salts as will produce a white precipitate with the alkali employed in the said manufacture, as described. Third,—the plan and method herewithin described of rendering starch more soluble, and of enabling it to give a better glaze, by treating the same with malt, malt flour, or a solution of diastase."

To George Evans, *of Gloucester-terrace, Portman-square, for improvements in treating peat, to render it useful as fuel, and for illuminating and metallurgical purposes.*—[Dated 2nd November, 1861.]

The object of one part of this invention is to readily deprive raw peat of so much of its moisture as may leave it fit for conversion while wet, and in its pulpy state, into such a consistence that within a few hours of being raised from the moor, it can be manufactured into fuel or material for other useful purposes. To attain this object, the patentee combines with the saturated peat mineral or vegetable carbon or charcoal, which, by abstracting its water, so alters its character, that the body or mass so formed can be readily compressed and moulded into shapes of any required size, while the materials so added do not injure the qualities of the peat, but rather improve them.

In using mineral carbon dust, the patentee prefers that of anthracite coal, the sulphurous coals not being so applicable for the purpose; but granulated peat, sawdust, spent tanners' bark, or such like substances of a combustible nature, which, after their combustion, leave little or no residuum behind, may be employed. In furtherance of the same object—that of drawing away from the peat a large amount of its superabundant water, and

altering its character so that it shall no longer resist compression, particularly for metallurgical purposes—unslaked lime or some other earthy minerals, used as fluxing agents, may be added.

In order to render fresh cut peat, as it is raised from the bog, immediately available for the manufacture of fuel, the patentee takes 100 parts of fresh cut peat and adds to it, according to the more or less saturated state in which it may be found, from 10 to 25 parts of vegetable or mineral carbon, or some other well-dried combustible materials, as hereinbefore stated, and he sometimes further adds from 3 to 5 parts of unslaked lime or some other earthy minerals, mixing and incorporating the whole well together in a pug mill or other suitable machine, till the mass is brought into a state of consistence suited to receive pressure and to be moulded into blocks, bricks, or forms of any other kind. A fuel of great heating power is thus obtained, useful for raising steam in ships, locomotive and stationary engines, and for a variety of other purposes. When the fuel is intended for the smelting furnace, it may be mixed and incorporated with the dressed ores of the metals and the required fluxes; thus supplying at one and the same time the fuel and the flux for the more ready reduction of the ores.

For the production of illuminating gas the patentee takes the crude oil obtained from coal, coal tar, the oil extracted from bituminous shale, petroleum oils, or any one or more of the cheaper hydro-carbonaceous materials of commerce, and incorporates them, singly or combinedly, with peat, adding if necessary, a small quantity of caustic lime, to facilitate the extraction of the water, and render more perfect the amalgamation of the peat with the oils; and in this manner a substance is produced from which gas for illuminating purposes can be obtained in great abundance, and which compound may be substituted for coal in the manufacture of lighting gas.

The patentee claims, "treating raw or wet peat in the manner described, to render it useful as a fuel for all purposes, and as a combined fuel and flux for smelting ores. Also, the combination with peat of the crude oils distilled from coal, coal tar, the oils distilled from bituminous shale, petroleum oils, and the cheaper hydro-carbons, either together or separately, for the production of a composition to be used in the manufacture of gas."

To PIERRE ALEXIS FRANCISSE BOBŒUF, *of Paris, for the preparation and application of certain new hemostatic and antiseptic agents.*—[Dated 30th September, 1861.]

THIS invention relates to the manufacture and application, as hemostatic agents of alkaline "phenates," and salts obtained by means of mineral and vegetable essential oils, soluble in caustic potash or soda.

Method of preparing alkaline phenates:—Take raw coal oil (peat or wood oils are equally good), and stir into it, either cold or under a low heat, about the sixth of its weight of caustic soda, of 36°, then pour into a vessel, in which there is a tap at bottom, and allow the mixture to settle at least two hours, and, if time permit, twelve hours; two different layers will be formed, the one thick, the other black and viscous; which latter remains at the lower part of the vessel, and is the phenate of soda. The patentee denominates as phenates, the combination of any of the acid oils with alkalis, because, among these acid oils, phenic acid is almost always

found. By opening the tap, the phenate will run slowly off, until the second layer is reached. This layer is composed of the neutral oils, which are recognized by their fluidity and limpidity. If the soda is well saturated by the acid oils, the phenate should not mark more than 16° to 17° Beaumé. If it should mark 22° or 25°, there would be an excess of base, and it would be necessary to mix it up with fresh raw coal oil, in order to ensure the obtaining of a neutral salt. Add water to the phenate until it only marks 8° Beaumé. Two layers will again be formed. The lower layer is again the new phenate of soda, and the upper layer a thick oil, which will become reconstituted, under the influence of the water. Draw off the new phenate, to use as required, adding water, to bring it down to the desired degree.

For fresh cuts and wounds, apply it at a strength of five degrees; for old wounds, which have ceased bleeding, at two degrees only. The oil, reconstituted by the addition of water, is a composition of acid oils, neutral oils, and naphthaline oils, and may be used to produce new alkaline phenates, by treating four parts of it with one part of caustic soda, stirring, drawing off, and so on, as for the first phenate. After the addition of water, napthaline only, which was in solution among the acid oils, would rise. Should it be desirable to use only phenic acid, or acid oils previously extracted, one part of phenic acid, or of acid oils, should be mixed with at least two-thirds their weight of caustic soda or potash, marking 36°; the mixture should be slightly heated, well stirred, and water added, to bring down the alkaline salt to eight degrees; heat up to boiling point for about two minutes; withdraw the heat, and allow the mixture to settle; decant the supernatant oils, and dilute down to five degrees. To ensure the alkaline salts diluted to five degrees being perfectly neutral, and without excess of base, it is better to stir them again cold, and add either fresh phenic acid or fresh acid oil; allow to settle, and filter.

The phenates or alkaline salts, obtained and prepared as before described, are applied to stop hemorrhage, as follows:—If the hemorrhage is the result of a cutting instrument, take a "compress," folded in four folds, and dip it in an alkaline solution of phenate of soda, at five degrees, and place it on the wound—its application causes neither pain nor irritation; press the compress, and apply on the outside, through a camel-hair brush or otherwise, more of the alkaline solution. Should the blood flow through it, apply a similar compress, and act as with the first, and so on; and rarely, if ever, will it be found that the hemorrhage is not entirely arrested after the fourth compress. This is the effect produced:—The blood which escapes will coagulate, on contact with the alkaline phenate contained in the first compress, and will form a black precipitate. If the quantity of phenate of soda, contained in the four folds of the first compress, is not sufficient to coagulate all the albumen in the blood which flows, that result will be obtained by the second, third, or fourth compress. The albumen will form a solid body, which will stop the hemorrhage, either by its coagulation or by contraction of the tissues in contact with the alkaline solution. If the hemorrhage results from a bayonet wound, or from a ball, inject the same alkaline solution two or three times in succession, then fill the wound with lint soaked with the solution. Three or four hours after the bleeding has stopped, care must be taken to remove carefully all the compresses placed upon or over the first, as the blood with which they have become impregnated becomes exceeding

hard: should they adhere strongly, remove them only after some days. When so closely adherent to the skin, they take the place of collodion. The superiority of these alkaline salts, as hemostatic agents, arises from the fact that, in addition to the property they possess of coagulating the albumen of the blood, like the perchloride of iron, they also have the effect of insensibilising the edges of the wound, and cause the injured tissues to contract and to harden, by acting upon them in a similar manner to tannic acid. The phenates and alkaline salts, as well as being applied in a liquid state, may be used dry, as hereinafter explained. To obtain the phenates in a dry and divided state, first, dip compresses, lint, or any other fabric, once, or oftener, in concentrated phenates, and dry after each immersion; then, when required for use, damp the material with a little water. Second, impregnate with the alkaline phenates, inert substances—such as carbons, insoluble earthy salts, and oxides—and dry them, and damp them or not, for use. To produce more energetic phenates, in a dry and pulverized state, insoluble phenates are used, such as those of lime and baryta phenates, which are obtained by double decomposition, by pouring a soluble salt of one of the substances above indicated in a solution of phenate of soda or of potash.

The patentee claims, "the manufacture and application, as hemostatic and antiseptic agents, of alkaline 'phenates' and salts, obtained by means of mineral and vegetable essential oils, soluble in caustic potash or soda, in manner, and for the purposes, hereinbefore described."

To GEORGE MOWBRAY GILBERT, *of Worcester, for improvements in preparing blue color, and in apparatus for applying such color to water.*—[Dated 28th October, 1861.]

THE preparations of blue coloring matter, according to this invention, are made up in the form of paste, or semi-fluid, which is preserved for use in suitable flexible vessels. The preparation of blue coloring matter, suitable for laundry purposes, may be varied in its composition so long as the object of the invention is accomplished, viz., that the blue coloring matter shall be made up into a soluble paste, or semi-fluid condition, in such manner, and contain such ingredients, that the paste or semi-fluid composition will retain its partially fluid state, and not be liable to become dry when out of use for a length of time. These paste-like or partially fluid compositions of blue coloring matter are packed in suitable cases, which, when they are to be used in place of the ordinary blue bags of the laundry, are made of metal, tin, or lead, similar to those which have heretofore been used for storing artists' colors, and other matters where the colors have been expressed from one end by compressing the other end progressively, till the contents of a vessel or case have been drawn out. To render such vessels suitable for use in place of the ordinary blue bags used in laundries, near the outlet end of the case a partition is fitted, around which, and between it and the interior of the case, the edges of a porous bag of flannel are tied before forcing the partition into the case, so that the upper end of the case is lined with such bag. The upper end of the case is perforated with numerous holes, so that when a quantity of the paste or semi-fluid preparation of soluble blue coloring matter is pressed through a hole in the partition into, and is contained in,

the bag, the case may be used by placing the outlet end thereof in water, and by moving it therein, the desired quantity of blue color may be diffused in the water.

The preparations of coloring matters which are preferred are as follows: —For heavy linen—one part indigo, two parts ultramarine, four parts honey, ten parts chloride of sodium, two parts terra alba. For fine linen—three parts ultramarine, six parts honey, ten parts chloride of sodium, two parts terra alba.

It should be stated that other ingredients may be used in preparing these compositions, either in place of, or in combination with, those mentioned, so long as they are such as will increase, or not materially interfere with, the preparations retaining their partial fluidity."

To WILLIAM JOHN HAY, *of Southsea, for improvements in protecting iron and wooden ships, caissons, dams, and other wooden or iron structures from decay, and from fouling by vegetable and animal matter, and in preparing the materials employed therein.*—[Dated 12th November, 1861.]

THIS invention consists in an improved method of treating the oxides of copper and other metals, to prevent the uncertainty of their action by imperfect or not uniform application, when used for keeping ships' bottoms or other structures free from animalculæ and other animal and vegetable matters; also when used to preserve wood and other materials from decay and the ravages of insects; for which purposes black or protoxide of copper is ground in linseed oil, and then boiled with linseed oil until reduced to the suboxide: by thus oxidising and oxidating the oil, a quick drying cupreous oil is formed, which suspends the oxide in the form of a paint or varnish. To this is sometimes added a small portion of silver or other metals and oxides. In those cases where greater durability is required from ships being in foreign stations, or not able to be docked periodically, to the above mentioned paint an additional quantity of finely ground suboxide of copper is added; or, when the paint is required to be black, the black oxide of copper is added in the same manner. The paint or varnish may be thinned by spirits of turpentine, naphtha, or any other cheap spirits. When it is to be applied to iron, one or two protective or non-conducting coats should be first applied. This may be red or white lead, paint or asphalte varnish, or waterproof glue in its liquid state, or other suitable material.

The invention also consists in the use of zinc, either amalgamated or not, in contact with the inside or outside of iron vessels, ships' iron casings, and other structures, as a protection against electro-chemical action arising from any imperfect application of the protective varnish, paint, or other material, or from the accidental abrasion of the said protective coatings, or otherwise.

The patentee claims, "First,—protecting iron and wooden ships, caissons, dams, and other wooden or iron structures from decay and from fouling, by coating or covering the same with the materials and in manner hereinbefore described. And, Second,—preparing the materials for the purposes aforesaid, in manner hereinbefore described."

Scientific Notices.

INSTITUTION OF MECHANICAL ENGINEERS.

June 30, 1862.

JAMES FENTON Esq., Vice-President, in the Chair.

The paper read was, "*On a regenerative gas furnace, as applied to glass-houses, puddling, heating, &c.*," by Mr. C. William Siemens, of London.

The arrangement of furnaces about to be described is applicable with the greatest advantage in cases where great heat has to be maintained: as in melting and refining glass, steel, and metallic ores, in puddling and welding iron, and in heating gas and zinc retorts, &c. The fuel employed, which may be of very inferior description, is separately converted into a crude gas, which, in being conducted to the furnace, has its naturally low heating power greatly increased by being heated to nearly the high temperature of the furnace itself, ranging to above 3000° Fahr.; undergoing at the same time certain chemical changes, whereby the heat developed in its subsequent combustion is increased. The heating effect produced is still further augmented by the air necessary for combustion being also heated separately to the same high degree of temperature, before mixing with the heated gas in the combustion chamber or furnace; and the latter is thus filled with a pure and gentle flame of equal intensity throughout the whole chamber. The heat imparted to the gas and air before mixing is obtained from the products of combustion, which, after leaving the furnace, are reduced to a temperature frequently not exceeding 250° Fahr. on reaching the chimney; thereby effecting great economy in fuel, with other advantages.

The transfer of heat from the products of combustion to the air and gas entering the furnace, is effected by means of regenerators, the principle of which has been recognised to some extent since the early part of the present century, but has not hitherto been carried out in any useful application in the arts, unless the respirator invented by Dr. Jeffreys be so considered. The discovery of this principle is ascribed to Rev. Mr. Stirling, of Dundee, who, in conjunction with his brother, James Stirling, attempted as early as the year 1817 to apply it to the construction of a hot-air engine: their engine did not, however, succeed, nor did Captain Ericsson's later attempts in the same direction lead to more satisfactory results. The economical principle of the regenerator having attracted the writer's attention in 1846, he constructed in the following year an engine in which superheated steam was used in conjunction with the regenerator: many practical difficulties, however, prevented a realisation of the success which theory and experiments appeared to promise; but it is gratifying to find that one principle then adopted—that of superheating the steam—has since received the sanction of an extended application.

The employment of regenerators for getting up a high degree of heat in furnaces, was suggested in 1857 by the writer's brother, Mr. Frederick Siemens, and has since been worked out by them conjointly through the several stages of progressive improvement. The results

obtained by the earlier applications of the principle were communicated by the writer in a paper read at a former meeting of the Institution, and two or three of the furnaces then described, employed for heating bars of steel, still remain in operation. In attempting, however, to apply the principle to puddling, and other larger furnaces, serious practical difficulties arose, which, for a considerable time, frustrated all efforts; until, by adopting the plan of volatilising the solid fuel in the first instance, and employing it entirely in a gaseous form for heating purposes, practical results were at length obtained, surpassing even the sanguine expectations previously formed.

In the early form of the regenerative heating furnace, which has been in continuous work during the last three years for heating bars of steel at Messrs. Marriott and Atkinson's Steel Works, Sheffield, and also at the Broughton Copper Works, Manchester, there is a single fireplace containing a ridge of fuel, fed from the top, and two heating chambers, in which the bars of metal to be heated are laid with a regenerator at the end of each chamber, by which the waste heat passing off from the furnace is intercepted on its way to the chimney, and transferred to the air entering the furnace. Each regenerator is composed of a mass of open fire-bricks, exposing a large surface for the absorption of heat through which the products of combustion are made to pass from the furnace, and are thus gradually deprived of nearly all their heat previous to escaping into the chimney. The end of the regenerator nearest the furnace becomes gradually heated to nearly the temperature of the furnace itself, while the other end nearest the chimney remains comparatively cool. The direction of the draught being now reversed by means of a valve, the air entering the furnace is made to pass through the heated regenerator in the contrary direction, encountering first the cooler portions of the brickwork, and acquiring successive additions of heat in passing through the regenerator, until it issues into the first chamber of the furnace at a very high temperature, and, traversing the ridge of fuel, produces a flame which fills the second heating chamber; whence the products of combustion passing through the second cold regenerator deposit their heat successively in the inverse manner, reaching the chimney comparatively cool. By thus alternating the current through the two regenerators, a high degree of temperature is maintained constantly in the furnace. This arrangement of furnace is evidently applicable only in exceptional cases where two chambers are to be heated alternately, nor does it admit of being carried out upon a large scale.

In heating a single chamber the expedient was resorted to of providing two fireplaces, to be traversed in succession by the heated air, with the heating chamber placed between. Here the difficulty arose that the air, the oxygen of which was already combined with carbon (forming carbonic acid) in traversing the first fireplace, took up a second equivalent of carbon (forming carbonic oxide) in traversing the second, so that the fuel of the second fire was consumed to no purpose. In order to diminish this loss, and also avoid impairing the draught by a double resistance, the ridges of fuel were discontinued, and the coal was fed into the furnace from the sides resting on a solid hearth, to be there volatilised by the heated air passing over it. By frequently stirring the first fire, its combustion, was favoured until the current was

reversed, when it was left undisturbed until the next change, and so on alternately. It was found very difficult, however, to maintain an active and uniform combustion, and to burn the purely carbonaceous substance that was left in the fireplace after the gaseous portion of the fuel had been volatilised; and it had frequently to be raked out in order to make room for fresh gaseous fuel. This circumstance led to the first step towards the employment of fuel in the form of gas, by providing a small grate below the heap of fuel, through which a gentle current of air was allowed to enter, forming carbonic oxide, which afterwards further combined with oxygen on meeting with the hot current of air entering the furnace from the regenerator. The two fireplaces of alternating activity were, however, attended with considerable practical inconvenience; the furnacemen, in particular, disliked the idea of attending two fireplaces instead of one, and being little interested in the saving of fuel, took no pains to work the furnace in a satisfactory manner.

It therefore became necessary to devise a plan of heating a single chamber continuously by one fireplace, in combination with the alternate reversal of currents through the regenerators, but without reversing the direction of the flame. This was accomplished by means of double reversing valves, and was practically carried out in a puddling furnace that worked for a considerable length of time at the ironworks of Messrs. R. and W. Johnson, near Manchester.

There still remained drawbacks, however, which prevented an extensive application of this form of furnace: the fire required frequent attention, and it was difficult to maintain a uniform volume of flame in the furnace; the reversing valve at the hot end of the regenerators was, moreover, liable to get out of order, and the furnace was costly to erect.

The most important step in the development of the regenerative furnace, has been the complete separation of the fireplace or gas producer from the heating chamber or furnace itself. When a uniform and sufficient supply of combustible gas is ensured, it can evidently be heated just like the air, by being passed through a separate regenerator before reaching the furnace, whereby its heating power is greatly increased. The difficulty of maintaining a uniform flame in the furnace is thereby certainly removed, and there is no longer any necessity for keeping the flame always in the same direction through the furnace, since the gas can be introduced with equal facility at each end of the heating chamber in turn, and the periodical change of direction of the flame through the furnace tends only to make the heat more uniform throughout. The new plan of a separate gas producer has now been successfully carried out in practice, and there are already a considerable number of the regenerative gas furnaces in satisfactory operation in this country and on the continent, applied to glass-houses, iron furnaces, &c. In the neighbourhood of Birmingham, at Messrs. Lloyd and Summerfield's glass works, a flint glass furnace, constructed upon this plan, has now been in continuous operation for nearly twelve months, and affords a good opportunity for ascertaining the consumption of fuel of the regenerative furnace as compared with the previous furnace performing the same work. At the glass works of Messrs. Chance, Brothers, and Co., near Birmingham, the regenerative gas furnace has

been under trial for the same length of time, and has latterly been adopted for the various purposes in crown and sheet glass making upon a very large scale. Messrs. James Russell and Sons, Crown Tube Works, Wednesbury, are also applying the furnace to the delicate operation of welding iron tubes. Another flint glass furnace, erected by Messrs. Osler in Birmingham, and several puddling furnaces erected by Messrs. Gibbs, Brothers, at Deepfields, and by Mr. Richard Smith, at the Round Oak Iron Works, are amongst the latest applications of the regenerative gas furnace, the designs having in all cases been furnished by the writer, and carried out under his brother's immediate superintendence.

The gas producers are entirely separate from the furnace where the heat is required, and are made sufficient in number and capacity to supply several furnaces. The fuel is supplied at intervals of from six to eight hours through covered holes, and descends gradually on an inclined plane, set at an inclination of from 45° to 60° according to the nature of the fuel used. The upper portion of the incline is made solid, being formed of iron plates covered with fire-brick; but the lower portion is an open grate formed of horizontal flat steps. At the foot of the grate is a covered water trough, filled with water up to a constant level from a small feeding cistern, supplied by a water pipe with a ball tap. Below the water trough is an opening for drawing out clinkers, which generally collect at that point. Small stoppered holes are provided at the top of the producer, to allow of putting in an iron bar occasionally to break up the mass of fuel and detach clinkers from the side walls. Each producer is made large enough to hold about ten tons of fuel in a low incandescent state, and is capable of converting about two tons of it daily into a combustible gas, which passes off into a gas flue leading to the furnaces.

The action of the gas producer in working is as follows:—The fuel descending slowly on the solid portion of the inclined plane, becomes heated, and parts with its volatile constituents, the hydro-carbon gases, water, ammonia, and some carbonic acid, which are the same as would be evolved from it in a gas retort. There now remains from 60 to 70 per cent. of purely carbonaceous matter to be disposed of, which is accomplished by the slow current of air entering through the grate, producing regular combustion immediately upon the grate; but the carbonic acid thereby produced, having to pass slowly on through a layer of incandescent fuel, from three to four feet thick, takes up another equivalent of carbon, and the carbonic oxide thus formed passes off with the other combustible gases to the furnace. For every cubic foot of combustible carbonic oxide thus produced, two cubic feet of incombustible nitrogen pass also through the grate, tending greatly to diminish the richness or heating power of the gas. Not all the carbonaceous portion of the fuel is, however, volatilised on such disadvantageous terms; for the water trough at the foot of the grate, absorbing the spare heat from the fire, emits steam through small holes, under the lid; and each cubic foot of steam, in traversing the layer of from three to four feet of incandescent fuel, is decomposed into a mixture consisting of one cubic foot of hydrogen and nearly an equal volume of carbonic oxide, with a variable small proportion of carbonic acid. Thus, one cubic foot of steam yields as much inflammable gas as

five cubic feet of atmospheric air; but the one operation is dependent upon the other, inasmuch as the passage of air through the fire is attended with the generation of heat, whereas the production of the water gases, as well as the evolution of the hydro-carbons, is carried on at the expense of heat. The generation of steam in the water trough being dependent on the amount of heat in the fire, regulates itself naturally to the requirements; and the total production of combustible gases varies with the admission of air; and since the admission of air into the grate depends, in its turn, upon the withdrawal of gases evolved in the producer, the production of the gases is entirely regulated by the demand for them.

In order to deliver the gas into the furnace without depending upon a chimney draught for that purpose, the following plan has been adopted:—The mixture of gases, on leaving the producers, has a temperature ranging between 300° and 400° Fahr., which must, under all circumstances, be sacrificed, since it makes no difference to the result at what temperature the gas to be heated enters the regenerators; the final temperature being in all cases very nearly that of the heated chamber of the furnace, or, say, 2500° Fahr. The initial heat of the gas is, therefore, made available for producing a plenum of pressure by making the gas rise about 20 feet above the producers, then carrying it through a horizontal tube twenty or thirty feet long, and letting it again descend to the furnace. The horizontal tube, being exposed to the atmosphere, causes the gas to lose from 100° to 150° of temperature, which increases its density from 15 to 20 per cent. and gives a preponderating weight to that extent to the descending column, urging it forwards into the furnace.

The author then described the application of the regenerative gas furnace to a melting furnace in course of erection at the British Plate Glass Works, near St. Helen's. This furnace was selected because of its improved details of construction. The heating chamber of the furnace contains twelve glass pots, which are got out through the side doors when the glass is ready for casting upon the moulding table. Underneath are placed transversely four regenerators, composed of open fire-bricks built up on a grating: they are arched over at top, and support the bed or siege of the furnace. The regenerators work in pairs,—the two under the right-hand end of the siege, communicating with that end of the heating chamber, while the other two communicate with the opposite end. The gas enters the chamber through three passages, and the air through two intermediate passages, whereby they are kept entirely separate up to the moment of entering the furnace, but are then able immediately to mingle intimately, producing at once an intense and uniform flame in the heating chamber. The siege is built of fire-brick, with a number of transverse channels, through which the cold entering air is made to pass on its way into the air flue. By this means, the siege is kept comparatively cool, so that no fluid glass can pass through crevices into the regenerators. Any melted glass that may fall from the heating chamber through the apertures at the ends of the siege does not get into the regenerators, but falls into pockets, whence it can be removed through openings in the side walls. The passage by which the air enters affords the means of getting at the regenerators through an opening at the end of each.

From the air flue, the entering air is directed by a reversing valve into the air regenerator, and there becomes heated, ready for entering the furnace; at the same time, the gas entering from the gas flue is directed by a reversing valve into the gas regenerator, where it becomes heated to the same temperature as the air. Similarly, the products of combustion, on leaving the opposite end of the furnace, pass down through the second pair of regenerators, and, after being here deprived of their heat, are directed by the reversing valves into the chimney flue. When the second pair of regenerators have become considerably heated by the passage of the hot products of combustion, and the first pair correspondingly cooled by the entering air and gas, the valves are reversed, and the currents caused to pass through the regenerators and the heating chamber in the contrary direction; whereby the hot pair of regenerators is now made use of for heating the gas and air entering the furnace, while the cool pair abstracts the heat from the products of combustion escaping from the furnace. The supply of air and gas to the furnace is regulated by adjustable stop valves, whereby the nature and volume of the flame in the furnace may be varied at pleasure; whilst the chimney damper is used to regulate the amount of pressure in the furnace in relation to the atmosphere, so as to allow the opening of working holes.

In setting out each individual furnace, the heating effect required, the quality of the fuel employed, and the particular nature of the process to be performed, have to be considered. The amount of heat required determines the capacity of the regenerators: and the gas regenerators require fully as large a capacity as the air regenerators, and sometimes even a greater. This would, perhaps, hardly be expected, but will be seen to be the case from the following considerations. The gases proceeding from the gas producers are a mixture of olefiant gas, marsh gas, vapour of tar, water and ammoniacal compounds, hydrogen gas, and carbonic oxide; besides nitrogen, carbonic acid, some sulphuretted hydrogen, and some bisulphuret of carbon. The specific gravity of this mixture averages 0·78, that of air being 1·00; and a ton of fuel, not including the earthy remnants, produces, according to calculation, nearly 64,000 cubic feet of gas. By heating these gases to 3000° Fahr., their volume would be fully six times increased, but, in reality, a much larger increase of volume ensues, in consequence of some important chemical changes effected at the same time. The olefiant gas and tar vapour are well known to deposit carbon on being heated to redness, which is immediately taken up by the carbonic acid and vapour of water—the former being converted into carbonic oxide, and the latter into carbonic oxide and pure hydrogen. The ammoniacal vapours and sulphuretted hydrogen are also decomposed, and permanently elastic gases, with a preponderance of hydrogen, are formed. The specific gravity of the mixture is reduced, in consequence of these transformations, to 0·70, showing an increase of volume from 64,000 to nearly 72,000 cubic feet per ton of fuel, taken at the same temperature. This chemical change represents a large absorption of heat from the regenerator, but the heat is given out again by combustion in the furnace, enhancing the heating power of the fuel beyond the increase due to elevation of temperature alone.

The advantages of the regenerative gas furnace are of equal value in

the case of puddling and welding iron. In a puddling furnace constructed on this plan, the four regenerators are arranged longitudinally underneath the puddling chamber, which may be of the usual form. In order to complete the combustion of the gas and air in passing through the comparatively short length of the puddling chamber, it is necessary to mix them more intimately than is requisite in the large glass furnaces. For this purpose, a mixing chamber is provided at each end of the puddling chamber, and the gas and air from the regenerators are made to enter the mixing chamber from opposite sides; the gas aperture is, moreover, placed several inches lower than the air aperture, so that the lighter stream of gas rises through the stream of air, while both are urged forward into the puddling chamber, and an intense and perfect combustion is produced. The mixing chambers are sloped towards the furnace, in order to drain them of any cinders which may get over the bridge. The reversal of the current through the furnace is effected about every hour, by reversing valves in the air and gas flues, the arrangement of which is exactly similar to that already described in the glass furnace: the supply of gas and air is regulated by throttle valves, and the draught through the furnace by the ordinary chimney damper.

This same arrangement, with obvious modifications, may be applied also to blooming and heating furnaces, the advantages in both cases being a decided saving of iron, besides an important saving in the quantity and quality of the fuel employed. The space saved near the hammer and rolls by doing away with fireplaces, separate chimney stacks, and stores of fuel, is also a considerable advantage in favour of the regenerative gas furnace in ironworks. The facility which it affords for either concentrating the heating effect, or diffusing it equally over a long chamber, by effecting a more or less rapid mixture of the air and gas, renders the furnace particularly applicable for heating large and irregular forgings, or long strips or tubes, which have to be brought to a welding heat throughout. It has already been applied, to a considerable extent, in Germany for heating iron; having been worked out there under the direction of the writer's eldest brother, Dr. Werner Siemens, who has also contributed essentially to the development of the system. The furnaces at the extensive iron and engine works of M. Borsig of Berlin are being remodelled for the adoption of this system of heating, as have also been those at the imperial factories at Warsaw.

Another important application of the regenerative gas furnace is as a steel melting furnace, in which the highest degree of heat known in the arts is required,—presenting, consequently, the greatest margin for saving of fuel. This application of the regenerative gas furnace is rapidly extending in Germany, but has not yet practically succeeded in Sheffield, where it was also tried: it is, however, in course of application at the Brades Steel Works, near Birmingham.

Other applications of the regenerative gas furnace are being carried out at the present time; among which may be mentioned, one to brick and pottery kilns, for Mr. Humphrey Chamberlain, near Southampton; for Messrs. Cliff, of Wortley, near Leeds; and for Mr. Cliff, of the Imperial Potteries, Lambeth; also to the heating of gas retorts at the Paris General Gas Works, and at the Chartered Gas Company's Works, London.

The description already given, however, is sufficient to show the facility with which this mode of heating may be adapted to the various circumstances under which furnaces are employed. The important application of the regenerative system to hot-blast stoves for blast furnaces, by Mr. E. A. Cowper, has already been communicated to the Institution.

The experience hitherto obtained with the regenerative mode of heating, shows that it is attended with the greatest proportionate advantage in localities where good coal is scarce, but where an inferior fuel abounds. This applies most forcibly to the South Staffordshire district, where the best coal, in lumps, is worth 12*s.* 6*d.* per ton, whereas good slack can be had at 3*s.* or 4*s.* per ton. The question gains, moreover, in importance when it is considered that, according to the best authorities, the thick coal of the district is coming to an end, while millions of tons of coal dust have accumulated, of no present commercial value, which, on being converted into gas in the manner described, by means of the gas producers, would acquire a heating value equal, at any rate, to the same weight of the best coal, in the manner in which it is at present used. Considering also the proximity of the pits to the ironworks in this district, it may be suggested, whether the gas producers, being of very simple construction, might not with advantage be placed near the banks of fuel, above or even under ground,—the gas being conveyed to the works by a culvert, so as to supersede carting of the fuel. Such an arrangement might notably contribute to perpetuate the high position which South Staffordshire has so long maintained as an iron producing district.

Scientific Adjudication.

HOUSE OF LORDS.

June 5th, 1862.

Before the Lord Chancellor, Lord Brougham, Lord Cranworth, Lord Wensleydale, Lord Chelmsford, and Lord Kingsdown.

Betts *v.* Menzies and Another.

This was an appeal, arising out of an action brought by the appellant against the respondent for the alleged infringement of a patent, granted in 1849, for making the well-known metallic capsules for bottles from sheets obtained by placing an ingot of lead one-fourth of an inch thick upon an ingot of tin one-twentieth of an inch thick, and passing them between the rollers of a flatting mill, which causes the two metals to unite, and form a tough, flexible, and silvery-looking sheet. The cause was tried at the Middlesex Nisi Prius sittings, after Hilary Term, 1859, before Chief Justice Erle, then one of the judges of the Court of Queen's Bench, when the respondent contended that the patent was bad, for want of novelty in the invention, which had been described in the specification of a patent granted to one Thomas Dobbs, in 1804. The jury found a verdict for the plaintiff on all the issues, subject to leave reserved for the defendants to move the Court above to enter the verdict for themselves on the first and second pleas. In Easter Term,

1859, the defendants obtained a rule *nisi* to set aside the verdict for the plaintiff, and to enter a verdict for themselves, which was subsequently made absolute; the Court of Queen's Bench being of opinion that Dobbs's specification was anticipatory of the plaintiff's patent. The plaintiff appealed to the Court of Exchequer Chamber, who, in July, 1860, affirmed the decision of the Court of Queen's Bench. Hence the present appeal. The contention before their lordships, on behalf of the appellant, was that the judge at Nisi Prius was right in leaving the case to the jury—that the evidence was properly admitted at the trial, and that it was for the jury to decide what effect they would give to it, in reference to the question as to the novelty of the plaintiff's patent. It was further contended that the question whether the plaintiff's patent was made void for the want of novelty, by the publication of Dobbs's specification, was one partly of law and partly of fact, and that therefore the Court alone was not competent to decide it without the facts being admitted by both sides, which was not the case in the present instance; and that before the Court could decide, it must be informed of the meaning of the technical terms in Dobbs's specification—what was the nature and properties of the metal in the different states described in the two specifications, and of the effects of the operations described upon the metals in those different states. If the decision of the Court of Exchequer Chamber, that the plaintiff's patent was void, on account of the prior publication of Dobbs's specification, was to be taken as a correct decision upon a point of pure law, then it must be so on grounds independent of evidence, and no possible evidence in addition to the two specifications could affect the correctness of that decision. So that if Dobbs himself had proved that his patent was taken out on a conjecture, and that he had never known the thing to be done, and did not know how to do it, his specification would still have invalidated the plaintiff's patent. The specification of Dobbs's patent could not invalidate the plaintiff's patent, unless it were admitted by the plaintiff, or found by the jury, that Dobbs had specified something that could be put in practice. As to whether Dobbs's specification were practicable or not, that was entirely a question for the jury, who had decided the point in the plaintiff's favour. In conclusion, it was contended that it was impossible to ascertain the meaning of Dobbs's specification as a matter of law, without evidence. The counsel for the respondent contended, on the other hand, that the plaintiff's invention, or some material portion of it, was included in Dobbs's specification, and that therefore the plaintiff's patent was bad for want of novelty—that the construction of Dobbs's specification was for the decision of the Court, who were bound to take the words in their ordinary sense; and that the plaintiff's specification was ambiguous and uncertain, in not pointing out the proportions of lead and tin to be employed when the combined metal was to be used for other purposes than making capsules, and in not distinguishing between what was new and what was old at the date of the patent.

The case was argued, 27th February, 1862, before their lordships, assisted by the Lord Chief Baron, Justices Wightman, Williams, Byles, Blackburn, and Mr. Baron Wilde, when the following questions were put to the learned judges:—"1. Does it appear, on a comparison of the two specifications, that a material part of Dobbs's specification

is claimed by Betts in his specification? 2. If so, can the Court pronounce Betts's patent to be void, simply on the comparison of the two specifications, without evidence to prove identity of invention, and also without evidence that Dobbs's specification disclosed a practicable mode of producing the result, or some part of the result, described in Betts's patent?" The judges answered both questions virtually in the negative, on the grounds that may be gathered from the two following opinions, which represent, substantially, those of the other learned judges who were present at the argument.

Mr. BARON WILDE.—My lords, I propose to state the meaning of the two specifications as I construe them before I compare them. I construe Betts's specification thus:—I read the words, "which for the manufacture of the material for capsules may be four or five inches wide by about three-quarters of an inch thick, and about thirty inches in length," as a parenthesis ending at the the word "length." If this be correct, the process of manufacture described, is described for the new material generally, whether intended for capsules or other purposes. Again, I construe the claim to be "the manufacture (or making) of the new material in the manner previously described." That is, I read the words "as herein described" as over-riding the whole claim. The particular process previously described thus constitutes the substance of the claim. It is not the uniting of the metals by pressure, nor the rolling of them together, which the patentee lays claim to, but it is the making of a certain definite new material in a definite and limited particular manner.

The invention, therefore, given to the world by Betts was this:—That an ingot of lead, previously rolled out till about one-fourth of an inch thick, if laid upon an ingot of tin previously rolled out to one-twentieth the thickness of the lead, would, if passed through the rollers of a flatting mill, combine together and unite into one substance. The further condition of success being, that the tin be brought very evenly into superficial contact with the lead before subjecting them to pressure together.

On turning to Dobbs's specification, I find an invention described of great generality. The fact disclosed to the public by Dobbs was, that lead and tin in any proportions, and in ingots or plates of any size (capable of being pressed between the rollers of a flatting mill) would, if passed once or more through such rollers, unite: and the only further condition of success indicated is, that the surfaces of the metals should be clean.

The result of the comparison thus instituted is, that the general fact stated by Dobbs does include the specific process indicated by Betts. And if a Court of Law were bound to decide on the mere language of the two specifications, it ought, in my opinion, to decide that the publication of the general fact in general terms had anticipated the invention of a specific mode which fell within those terms. But I am of opinion that the Court is not so bound.

Such a rule might obviously work great injustice, as I am about to show. If rolling the two metals in any proportions, and by the general means indicated by Dobbs, will succeed, then Betts was anticipated, although he first indicated special proportions and a detailed method. On the other hand, if either the proportions of the two metals, or the details of the process specified by Betts, are really indispensable to success, he was an inventor, and was not anticipated by Dobbs. Here, then, is a fact to be inquired into, and one that can only be determined upon evidence, and consequently by a jury. And until this question of fact is solved, the reality of Betts's invention and the anticipation of it or not by the publication of Dobbs, cannot justly be determined.

For these reasons I answer the second question in the negative. I hold the rule to be this:—If the terms of the two specifications are identical, and if it is not disputed that the terms of art used in the one have the same meaning as the same terms used in the other, which, from the lapse of time between the dates of the two patents, may not always be the case, the Court ought to deter-

mine that the first publication anticipated the second without evidence, and without any proof that either the first or second was practicable. If, though not identical, the language used in the two, when construed by the Court, describes identically the same process, machine, or manufacture, the Court may (subject to the same remark as to the terms of art) decide at once upon the question of anticipation. But if after construction, and after the meaning of the parties in the two documents has been ascertained by the Court, there be any difference between the two things described, which *may* be essential or material to the invention, and which is contended by either of the two parties to be essential or material to the invention, the Court cannot decide such a controversy; it has neither materials nor means for so doing, and it must go to a jury.

In a word, the Court can pronounce two identical descriptions to pourtray two identical inventions; but when the descriptions are different, the identity in substance of the two inventions is a matter to be established by extrinsic evidence. Applying this rule to the case in hand, I hold that Mr. Betts, in the proportions of the two metals, in the rolling of the two metals separately before rolling them together, and in other details of his process, has indicated a mode of procedure for making his new material by no means identical with that published by Dobbs. This difference is contended to be essential to the invention; and it may be so; for it may turn out upon evidence, that except under the specific conditions pointed out by Betts, the combination of the two metals by pressure, as generally described by Dobbs, is not a practicable thing. The real question of novelty or anticipation is thus dependent upon a fact, and being so, the intervention of a jury is the necessary result.

Mr. Justice Byles.—My Lords, in reply to the first question proposed by your Lordships, I am of opinion that, on a comparison of the two specifications, a material part of Dobbs's specification is claimed by the plaintiff's specification.

Dobbs's specification embraces any coating or plating of lead with tin in any proportions, by means of mechanical pressure. But Betts's specification states certain proportions (whether it claims them or not) and certain processes in the application of the pressure, by which proportions and processes the coherence of the two metals may be certainly accomplished. Dobbs's process is the *genus*, Betts's the *species*.

In answer to the second question, I am of opinion that a Court of Law cannot pronounce Betts's patent void, simply on the comparison of the two specifications, without evidence that Dobbs's specification disclosed a practicable mode of producing the result, or some part of the result, described in Betts's patent.

It does not appear to me, that a comparison of the two specifications shows the two processes to be so far the same, that if the second process with Betts's directions be practicable, the first, with Dobbs's directions, and no more, must have been practicable also.

Without evidence, I think it is impossible to see that Dobbs's process (described in general terms as he has described it) was more than an experiment or a suggestion. It is not imputing to a Court of Law an affectation of judicial blindnesss to say that, without evidence, the Court cannot discover whether the previous separate rolling of the two metals, as described by Betts, be or be not essential to the practical success of the process. How can a Court of Law, without evidence, know the relative extendibility of the two metals lead and tin, or judge whether the relative thicknesses of the lead and tin (or about the relative thicknesses), as described by Betts, be or be not essential?

For these reasons, I answer the first of your Lordships question in the affirmative, and the second in the negative.

Their Lordships having allowed the case to stand over from February, now pronounced judgment.

Lord Chancellor.—My Lords, in this appeal the appellant, who was the plaintiff below, brought an action against the respondents, for an infringement of his patent. The date of that patent was the 13th of January, 1849. One of

the issues raised in the action was the alleged want of novelty in the invention of the plaintiff; the jury found a verdict for the plaintiff on all the issues. The defendants had leave reserved to them to enter a verdict for themselves on the issues founded on the first and second pleas.

The second plea was, that the plaintiff's invention, or a material part of it, was included in the specification of a patent granted to one Thomas Dobbs, in the year 1804. The Court of Queen's Bench were of opinion that, on that second plea, the rule ought to be made absolute. The plaintiff appealed to the Court of Exchequer Chamber, where, by a majority of the Judges, the judgment of the Queen's Bench was affirmed. From that judgment, so affirmed, the present appeal is brought to your Lordship's House.

My Lords, the question was very learnedly and ably argued before your Lordships, assisted by several of the learned Judges, and your Lordships thought fit to put to them two questions. Upon a reconsideration of those questions, I think it will appear that probably the first became immaterial to be considered, supposing the second question was answered in the negative. All the Judges have concurred, for reasons which, I think, must be extremely satisfactory to your Lordships, in answering the second question in the negative. There does not appear to have been quite the same unanimity of opinion with regard to the answer to be given to the first question; but, in reality, the second question being answered in the negative, the first question can hardly be said to arise.

My Lords, the second question was this:—"Can the Court pronounce Betts's patent to be void, simply on the comparison of the two specifications, without evidence to prove identity of invention, and also without evidence that Dobbs's specification disclosed a practicable mode of producing the result, or some part of the result, described in Betts's patent?"

The answer of the learned Judges involves, therefore, conclusions which are extremely material to the Patent Law. One is this—that even if there be identity of language in two specifications, remembering that those specifications describe external objects, even if the language be *verbatim* the same, yet, if there be terms of art found in the one specification, and also terms of art found in the other specification, it is impossible to predicate of the two, with certainty, that they describe the same identical external object, unless you ascertain that the terms of art used in the one have precisely the same signification, and denote the same external objects, at the date of the one specification, as they do at the date of the other.

And, my Lords, this is obvious; for if we take two specifications, dated as the present are, one in the year 1804, and the other in the year 1849, even if the terms employed in the one were identical with the terms employed in the other—supposing that each of them contains a term of art (we will assume it to be a definition of some engine, some instrument, some drug, or some chemical compound), it might well be that the thing denoted by that name in 1804 is altogether different from the thing denoted by that name in 1849. If it were necessary to enter into such a subject, I could give numerous examples—say from chemistry—of things that were denoted by one name in 1804, and which have retained the same denomination, but which, by improved processes of chemical manufactures, are at present totally different in their results, their qualities, and their effects, from the things denoted by the same names forty or fifty years ago. It is perfectly clear, therefore, that if you compare two specifications, even if the language be the same, you cannot arrive at a certainty that they denote the same external object and the same external process, unless you enter into an inquiry, and ascertain as a fact, that the things signified by the nouns substantive contained in the one specification are precisely the same as the things signified by the same nouns substantive contained in the other. In all cases, therefore, where the two documents profess to describe an external thing, the identity of signification between the two documents containing the same description must belong to the province of evidence, and not to the province of construction.

My Lords, I pass on to the next conclusion which is involved in the answer of the learned Judges to your Lordships' question, and that conclusion, I think, is also of great importance to the Law of Patents, because it results, from that opinion, that an antecedent specification ought not to be held to be an anticipation of a subsequent discovery, unless you have ascertained that the antecedent specification discloses a practicable mode of producing the result which is the effect of the subsequent discovery. My Lords, here we attain, at length, to a certain undoubted and useful rule. For the law laid down with regard to the interpretation of an antecedent specification is equally applicable to the construction to be put upon publications or treatises previously given to the world, and which are frequently brought forward for the purpose of showing that the invention has been anticipated. The effect of this opinion I take to be this, if your Lordships shall affirm it—that a barren general description, probably containing some suggested information, or involving some speculative theory, cannot be considered as anticipating, and as therefore avoiding, for want of novelty, a subsequent specification or invention which involves a practical truth, which is productive of beneficial results, unless you ascertain that the antecedent publication involved the same amount of practical and useful information.

Now, my Lords, it will be evident, upon a comparison of these two specifications, that the one was a mere general suggestion, while the other is a specific, definite, practical invention. It is possible that a suggestion, such as that contained in the one, may lead to the discovery of the invention contained in the other. But it is the latter alone which really does add to the amount of useful knowledge—it is the latter alone which, by its practical operation, confers a benefit upon mankind, within the meaning of the Patent Law. In the present case, there was not only no evidence to show that that which was contained in Dobbs's specification was capable of practical operation, but, in reality, that conclusion was negatived by the verdict of the jury. Therefore, my Lords, concurring, as I entirely do, in the conclusions which have been arrived at by the Judges, in answer to the second question, it results, as a necessary consequence, that the decision of the Court of Queen's Bench and of the Court of Exechequer Chamber ought to be reversed, and that the Rule *nisi*, made absolute by the Court of Queen's Bench, ought to be discharged. My lords, I move your Lordships, therefore, to embody these conclusions in your present order.

Lord Brougham.—My Lords, in the course of the argument, I had, and expressed, very considerable doubts on various parts of the case. Upon the whole, I consider those doubts as answered by the opinions of the learned Judges, and I agree with my noble and learned friend's proposition.

Lord Cranworth.—My Lords, the only question in this case is whether the plaintiff's invention was new. The jury found that it was. He is therefore entitled to judgment in his favour, unless, as a matter of law, the jury could not, on the evidence before them, lawfully come to the conclusions at which they arrived—in other words, unless there was evidence before the jury which made it their duty, as a matter of law, to find that the invention was not new.

The argument for the respondents was, that the absence of novelty was established conclusively by the production of Dobbs's specification—that in the face of that specification the jury could not find in favour of the plaintiff; and this was the opinion of the Court of Queen's Bench, and afterwards of the Exchequer Chamber. But I agree with the able opinion of the minority of the Judges in the Exchequer Chamber, and of the learned Judges whose assistance we had at the argument of this case, that the judgment below was wrong.

It may be true that two specifications may be so entirely identical that the Judge may be warranted in telling the jury, as matter of law, that they cannot find the second invention to be new; though that was not decided in Bush *v.* Fox, for there the jury found, as matter of fact, that the mode of working the two inventions was the same.

But here not only are the two specifications not identical, but in the earlier of them there is no trace of that which constituted the very essence of the plain-

tiff's invention, namely, the relative thickness of the tin and the lead, and the mode of rolling and laminating each metal separately before they are placed together, and then made to cohere by being rolled and laminated jointly.

Dobbs's specification disclosed no more than his notion that tin and lead might, by means of pressure, be so combined as to form a new and useful material. It gave no information as to how that object could be attained, and there was evidence to show that Dobbs had never been able, in working according to his specification, to succeed in making the metals unite. There was, therefore, an essential difference between the two specifications, which fully warranted the jury in finding a verdict for the plaintiff as they did.

The case has been so fully and ably discussed in the opinions of the learned Judges, and commented on by my noble and learned friend on the woolsack, that I shall content myself with simply saying that I concur in the motion that judgment be given for the plaintiff below, who is appellant here.

Lord Wensleydale.—My Lords, the result of the very full and able opinion delivered by my Lord Chief Baron on the questions propounded by your Lordships, and of the written opinions of the consulted Judges with which we have been supplied, is that the unanimous judgment of the Court of Queen's Bench and the judgment of the majority of the Court of Exchequer Chamber ought to be reversed. I concur entirely in the propriety of this course. It appears to me, without entering into all the questions which have been discussed at the bar, and on most of which the learned Judges have delivered their opinion, that my noble and learned friend, who has addressed the House, has put the case on a ground which is quite satisfactory, and, it appears to me, is perfectly unanswerable. The jury having found that the plaintiff's invention was new, unless the production of Dobbs's specification, without any other evidence, conclusively showed that it was not, the patent must be good. Now I am clearly of opinion that the mere production of Dobbs's patent, in which he makes public his notion that lead and tin might be usefully combined in a new material by mechanical pressure, without any statement or proof how that object could be attained, and a practical result secured, is insufficient to show that he had made prior discovery and was an inventor. If nothing was set out in a plea, but the plaintiff's and Dobbs's prior patent and specification, it would, I think, be unquestionably bad. It is not a disclosure of an invention.

I agree entirely with Mr. Justice Williams and Mr. Justice Willes in their opinion given in this case in the Court of Exchequer Chamber, that the mere publication of a notion that a particular article might be made without any information or means of knowledge communicated to the public, does not preclude a subsequent first inventor of those means from taking out a patent.

Very early in the argument it appeared to me, that without some evidence to show that Dobbs's patent is capable of a practical application, and would produce some useful effects, it was inoperative to affect Betts's invention, and so render his patent invalid; and it is much to be regretted that this view of the case was not fully discussed at an earlier period.

Judgment appealed from reversed, and judgment given for appellant.

PRIVY COUNCIL.

Before Lord Kingsdown, the Judge of the Admiralty Court, and Sir Edward Ryan.

July 2nd, 1862.

In Re Newton's Patent.

[The following report will be read with some interest, as it not only clears up a doubt which had often been expressed regarding the bearing of the 25th section of the Patent Act, 1852, on the extension of patents for

foreign or imported inventions, but gives an interpretation, never before contemplated, to the expressions contained therein. It will be remembered that this section is intended so far to limit the protection for an imported invention, already patented abroad, that the English public may be entitled to the use of the invention immediately on the expiration of the foreign patent under which it was first patented. The case now brought before the Privy Council was not considered to come within the meaning of the Act, as it was clearly beyond the terms of the section; because the English patent was obtained before the date of the foreign patent; morcover, the foreign patent was yet unexpired, and its renewal might confidently be relied on. But besides this, an extension, in 1861, of Newton's (Hoe's) printing press patent had been obtained under similar circumstances, it being then understood that the validity of the extension was only conditional on the extension of the American patent. The Privy Council, however, relying on their discretionary power, have now put such an interpretation on the Act as will effectually debar all foreign inventors and patentees from obtaining an extension of their British patents.]

This was an application for the prolongation of a patent granted to Mr. Alfred Vincent Newton (being a communication from Mr. Bentz, of Baltimore, U.S.A.) for "certain improvements in dressing or cleaning grain, and in separating extraneous matters therefrom."* It appeared that the original patent was granted on the 22nd of August, 1848, and that on the 19th of September, 1848, a patent was granted in the United States, also for fourteen years, in respect of the same invention. It was objected, on behalf of the Crown, that this application was inconsistent with the provisions of 15 and 16 Vict. c. 83, ss. 25, 40, which provides that where a patent has already been taken out for an invention in a foreign country, the English patent shall not endure longer than the foreign patent, and that no patent shall be granted in England after the foreign patent has expired; and 16 and 17 Vict. c. 115, s. 7, which places prolongations, granted since the first-mentioned Act, of patents granted before that Act on the same footing as prolongations of patents granted after that Act. And (at their lordships' desire) this question was argued before evidence was given in support of the application.

Mr. Grove, Q.C., and Mr. M'Rory, for the petitioner, cited 15 and 16 Vict., c. 83, ss. 25, 40; 16 and 17 Vict. c. 115, s. 7; *In re* Bodmer's patent; 8 Moore P. C. C. 282; *In re* Aubé's patent, 9 Moore P. C. C. 43; and contended that the provisions of the statute and the effect of the previous authorities were confined to cases in which the foreign patent had been granted, and had expired before the English patent.

The Attorney-General and Mr. Welsby, for the Crown, contended that the present case fell within the spirit of the above enactments, if not within the letter.

The Judge of the Admiralty Court delivered the judgment of their lordships.—This is an application for the prolongation of a patent which was granted in the month of August, 1848, for the term of fourteen years. It appears that about the time when the patent was granted, a

* For description of this invention, see Vol. 35, page 6, Conjoined Series.

similar application was made in the United States; and that, in consequence of that application, letters patent were granted there on the 19th September, 1848, for the same period of fourteen years. Now an application is made on behalf of the patentee in this country, or his assignees, praying their lordships to renew that patent. Their lordships have considered the cases which have been previously decided by the Judicial Committee of the Privy Council upon former occasions, and they are of opinion that those cases were all rightly decided; and they have no intention of departing from the principles there laid down. But it appears to their lordships that the decision of this case rests upon a very narrow principle indeed. The two patents were granted almost simultaneously; and though this case does not come within the letter of the statute, it appears to their lordships to come within the true spirit of it; and their lordships are of opinion that, under these circumstances, they, in the exercise of their discretion, ought not to advise her Majesty to grant a prolongation of the patent.

Solicitors for the petitioners, Messrs. Bower, Son, and Cotton.

Provisional Protections Granted.

1862.

[*Cases in which a Full Specification has been deposited.*]

1795. George Haseltine, of Fleet-street, for improvements in roofs for railroad cars and hurricane decks of vessels,—being a communication.—[*Dated June 17th.*]

1839. George Tomlinson Bousfield, of Loughborough-park, Brixton, for certain new and useful improvements in steam engine valves,—being a communication.—[*Dated June 21st.*]

1845. George Haseltine, of Fleet-street, for improvements in machinery for mowing and reaping; the driving gear employed being applicable to machines for other purposes,—being a communication.—[*Dated June 23rd.*]

1894. Marc Antoine François Mennons, of Paris, for improved apparatus for the prevention and reduction of synovial and other swellings or tumours in the limbs of horses,—being a communication.

1967. Orange Watson Child, of New York, for a new and useful composition to be used in shaft journal boxes,—being a communication.—[*Dated July 8th.*]

1971. Jean Marie Gille, of Paris, for an improved calendar inkstand.—[*Dated July 9th.*]

1990. Elmer Townsend, of Massachusetts, U.S.A., for a new and useful invention for making nails, and driving such nails into the sole of a boot or shoe,—being a communication.—[*Dated July 10th.*]

2006. Marc Antoine François Mennons, of Paris, for certain improvements in vessels mounted as floating batteries,—being a communication.—[*Dated July 12th.*]

[*Cases in which a Provisional Specification has been deposited.*]

652. Jean Nadal, of Brooke's-market, Holborn, for an improved portable fountain for water or other liquids.—[*Dated March 11th.*]

728. Alexander Southwood Stocker and Alexander Richmond Stocker, both of Wolverhampton, for improvements in the manufacture and construction of metal boot heels and tips, and horse shoes.—[*Dated March 17th.*]

807. Michael Henry, of Fleet-street, for improvements in kilns, ovens, and furnaces,—being a communication.—[*Dated March 22nd.*]

887. Marc Antoine François Mennons,

of Paris, for improvements in the manufacture from vegetable product of glucose or fermentable sugar,—being a communication.—[*Dated March* 31*st*.]

1051. John Henry Johnson, of Lincoln's-inn-fields, for improvements in fire-arms,—being a communication.—[*Dated April* 11*th*.]

1072. James Childs, of Victoria-street, Pimlico, for improvements in the manufacture of wax matches.

1074. Richard Archibald Brooman, of Fleet-street, for improvements in carriages for transporting loads on railways, common roads, and other surfaces,—being a communication.

The above bear date April 14th.

1131. Henry Gallagher, of Bermondsey, for improvements in overalls, leggings, or in overboots.—[*Dated April* 17*th*.]

1151. Alfred Pierre Tronchon, of Paris, for improvements in the construction of houses, palisades, and other similar constructions.—[*Dated April* 21*st*.]

1205. Thomas Woodhouse Ashby, of Stamford, for improved apparatus for obtaining motive power from the wind,—being a communication.—[*Dated April* 24*th*.]

1282. Alfred Henry Fielden, of Castle-street, Holborn, for improvements in show jars, lamps, signals, and lighthouses, and other methods of illumination.—[*Dated April* 30*th*.]

1329. Thomas Wilson, of Birmingham, for improvements in the manufacture of armour plates for ships of war and batteries, and in fastening or securing armour plates to ships of war and batteries.—[*Dated May* 5*th*.]

1389. Leopold D'Aubreville, of Paris, for improvements in metallic cross sleepers for railways,—being a communication.—[*Dated May* 9*th*.]

1434. Jean Daniel Gavillet and Jean Pierre Felix Gandon, both of Paris, for improvements in paddle-wheels, applied either for propelling steam boats or as prime movers.

1449. Michael Henry, of Fleet-street, for an improvement in, or addition to, gloves,—being a communication.

The above bear date May 13th.

1497. Robert William Sievier, of Guildford-street, Russell-square, for an improvement in rams for naval warfare.

1504. Charles Hippolyte Tessier, of Paris, for a new safety lock,—being a communication.

The above bear date May 17th.

1519. Marc Antoine François Mennons, of Paris, for improvements in the method of, and apparatus for, applying screw power to the locomotion of railway trains on steep inclines,—being a communication.

1520. Marc Antoine François Mennons, of Paris, for improved processes for the conversion of amylaceous matters into saccharine and other useful products,—being a communication.

1521. William Naylor, of Queen's-road, Dalston, for improvements in forging metals, and in power hammers employed therein.

1522. Rebecca Tallerman and Lewis Abraham Tallerman, both of Bishopsgate-street Without, for an improved method of protecting ladies' and children's boots and shoes.

1523. James Taylor, of Fenchurch-buildings, for improvements in abstracting heat from liquids and aeriform fluids, and in apparatus employed therein, and for other purposes.

1524. William Clark, of Chancery-lane, for improvements in paddle and other hydraulic wheels,—being a communication.

1525. Edward Fewtrell, of Birmingham, for improvements in the manufacture of metal tubes, and in machinery to be employed for that purpose.

1527. John Kennedy, of Whitehaven, for improvements in ship propellers.

1528. William Petrie, of Charlton, Kent, for improvements in vessels for boiling chemical products, as sulphuric acid, and in apparatus for indicating the degree of concentration and temperature of such products in the boiler; which apparatus is applicable to other pyrometric purposes.

The above bear date May 20th.

1529. Henry Bernoulli Barlow, of Manchester, for improvements in

presses for cotton and other substances,—being a communication.

1531. John Kennedy, of Whitehaven, for improvements in plates for plating and for forming the outside skin of ships and vessels, and in protecting the same from fouling and oxidation.

1532. William Hickling Burnett, of Margaret-street, Cavendish-square, for improvements in the mode of working telegraphic lines, and in instruments and apparatus employed for telegraphic purposes.

1533. Macedo Alexandre Le Brun Virloy, of Paris, for improvements in drying and carbonizing wood, peat, and other fuel.

1534. William Bush, of Tower-hill, for improvements in the construction of ships, and in shields or armour for ships and batteries.

1535. Alfred Giles, of Adelphi-terrace, Strand, for improvements in constructing floating breakwaters.

1536. Louis Leins, of Bucklersbury, for improvements in travelling bags and apparatus used therewith.

1537. Hermann Christian Meyer, of Hoxton, for improvements in the means of stopping or retarding railway and other carriages.

1538. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the manufacture of metallic or mineralized fabrics or surfaces,—being a communication.

The above bear date May 21st.

1539. John Oxley, of Old St. Pancras-road, for improvements in making wheels, and in the machinery to be employed therein.

1540. Charles William Siemens, of Great George-street, Westminster, for improvements in electric telegraph apparatus,—being partly a communication.

1541. James Hillert Perry, of Piccadilly, for an improved method of curing diseases of the human body by magnetism.

1542. Eugene de la Bastida, of Hart-street, Bloomsbury-square, for a new process for the production of designs in relievo, and in deepening on sheets of india-rubber of any length whatever,—being a communication.

1543. George Crawford, of Beaumont-street, Portland-place, for improvements in musical instruments.

1544. Joseph Needham, of Piccadilly, for improvements in breech-loading fire-arms, and in cartridges for such fire-arms.

1545. Samuel Turnbull and Frederick Turnbull, both of Shoreditch, for improvements in the manufacture of floor cloths and like coverings.

1546. John Kennedy, of Whitehaven, for improvements in protecting the sides and decks of ships from the effects of projectiles.

1549. George Barlow, of Birmingham, for a new or improved method of laying submarine telegraphic cables, —being a communication.

1550. Henry Cook, of Manchester, for improvements in electric batteries,—being a communication.

1551. William Roberts and Thomas Greenacre, both of Millwall, for improvements in cocks or valves for steam or other fluids.

1552. William Evans, of Commercial-road East, for improvements in obtaining motive power by machinery.

1553. Gôran Fredrik Gôransson, of Gefle, Sweden, for improvements in the construction and arrangement of armour plates, applicable to ships, forts, batteries, and other structures, and to a mode of securing the same.

The above bear date May 22nd.

1554. Peter Mc Gregor, of Manchester, for certain improvements in machinery for spinning and doubling cotton and other fibrous substances.

1555. Robert Blacklidge, of Accrington, for improvements in the preparation of materials for sizing, dressing, or finishing warps, yarns, textile fabrics, or paper; and also for thickening colors.

1556. Charles de Bergue, of Manchester, for improvements in machinery or apparatus for the manufacture of metal reeds for weaving.

1557. William Edward Wiley, of Birmingham, for improvements in the manufacture of certain kinds of penholders; which improvements may also be applied to pencil-cases and holders for crayons, and other solid writing or marking materials.

1558. James Webster, of Birmingham, for improvements in coating and indurating metals.
1559. Joseph Ward, of Radford, and John Dewick, of New Lenton, both in Nottingham, for improvements in machinery or apparatus for the manufacture of textile or looped fabrics.
1560. Eugène Mouline, of Vals, France, for improvements in apparatus used in weaving.
1561. Edwin Maw, of Leamington, for improvements in constructing ships, vessels, forts, and batteries.
1563. William Clark, of Chancery-lane, for a new manufacture of socks and stockings,—being a communication.

The above bear date May 23rd.

1564. George Thomas Livesey, of Old Kent-road, for improvements in purifying illuminating gas, and in treating the products obtained in the various processes of purification.
1565. John Harrison and Robert Parkinson, both of Blackburn, for improvements in the manufacture of rollers for preparing, spinning, doubling, sizing, winding, warping, and weaving.
1566. William Harrison, John Harrison, John Oddie, and William Parkinson, all of Blackburn, for certain improvements for winding, sizing, and weaving.
1567. Charles de Bergue, of Manchester, for improvements in iron framing, applicable to supporting coverings or surfaces intended to resist blows or pressure.
1568. Christopher Brakell, William Hoehl, and William Gunther, all of Oldham, for improvements in steam and other motive engines.
1569. Mark Walls and John Crompton, both of Bolton, for improvements in railway signals.
1570. Jacob Taylor, of Oldham, for improvements in machinery or apparatus for preparing cotton or other fibrous materials to be spun.
1571. Walter Brierley and George Frederick Smeeton, both of Halifax, for improvements in apparatus connected with targets.
1572. William Clark, of Chancery-lane, for improvements in the manufacture of buttons, and in the mode of fastening the same,—being a communication.
1573. William Worby, of Ipswich, for improvements in reaping machines.
1574. Jean André Cécile Nestor Delpech, of Castres, France, for improvements in pumps.
1575. Robert Michael Letchford, of Three Colts-lane, Bethnal-green, for an improvement in the manufacture of matches.
1576. George Augustus Huddart, of Brynkir, Carnarvonshire, for improved means for superheating steam.
1577. Joseph Ellicott Holmes, of New York, for improvements in machinery for digging or cultivating land.
1578. Joseph Ellicott Holmes, of New York, for improvements in machinery for digging or cultivating land,—being a communication.
1579. Joseph Ellicott Holmes, of New York, for improvements in printing machinery,—being a communication.
1580. Thomas Dutton Templer Sparrow, of Piccadilly, for an arrangement or arrangements for shading street lights, in order to protect or shade the eyes of riders and foot passengers from the dazzling effect of the flames of such lights.

The above bear date May 26th.

1581. Edmund Tuck, of Leadenhall-street, for certain improvements in electrical manipulation, applicable to submarine telegraphs.
1582. Charles Auguste Mathieu Durand, of Peujard, Gironde, France, for a new kind of water mill.
1583. William Edward Gedge, of Wellington-street, for improvements in the manufacture of wire ropes or cables,—being a communication.
1584. John Halliday, of Manchester, for improvements in the manufacture of ornamental trimmings.
1585. Jonathan Ireland, of Manchester, for improvements in forming moulds for card cylinders.
1586. Henry Duncan Preston Cunningham, of Alverstoke, Hants, for improvements in anchors.
1587. William Clark, of Chancery-lane, for improvements in brakes for railroad carriages,—being a communication.

1588. Frederick Tolhausen, of Paris, for a new or improved method of applying various mineral and organic substances to wire gauze, metallic and asbestos tissues, for rendering said tissues available for ornamental and useful purposes,—being a communication.

1589. George Henry Sanborn, of Boston, U.S.A., for improvements in revolving breech-loading fire-arms,—being a communication.

1590. John Hay, of Troon, Ayrshire, N.B., for improvements in war ships; also applicable in part to floating and land batteries or forts, and in part to mercantile and other vessels.

1591. John Duffus, of Cullen, Banffshire, N.B., for improved apparatus for measuring piece goods or webs.

1592. William Palmer, of New York, for improvements in revolving firearms.

1593. Dennis Topham Moss, of Leeds, for improvements in fastening horse shoes.

1594. George Henry Daw, of Threadneedle-street, for improvements in fire-arms.

1595. Charles Hodge Hudson, of Roxbury, Massachusetts, U.S.A., for improvements in defensive armour.

The above bear date May 27th.

1596. Henry Eaton, of Manchester, for improvements applicable to presses for baling purposes.

1597. John Howard Kidd, of Manchester, for an improved manufacture of compositions applicable for waterproofing fabrics for coating and protecting various articles, and for various other purposes.

1598. James Simpson, of Hulme, for improvements in machinery or apparatus for cutting or producing "mouldings" upon surfaces of wood or other suitable material.

1599. John Rogerson, of Newcastle-upon-Tyne, for an iron floating dock, to be used for the purpose of building and repairing ships, steamers, barges, and floating vessels of all descriptions.

1600. Charles Cohen, of Bury-street, for improvements in walking, umbrella, and other like sticks.

1601. James Fortescue Harrison, of Cambridge-square, Hyde-park, for improvements in preserving the bottoms of ships from the attacks of barnacles and other incrustations.

1602. Ralph Martindale, of Birmingham, for improvements in the manufacture of globes and glasses, more particularly applicable to hydrocarbon and spirit lamps; and also in fastenings for securing the globes or glasses in those and other descriptions of lamps.

1603. Thomas Turner, of Redditch, for improvements in machinery for scouring and polishing knitting and other pins and needles.

1604. Henry Saunders and John Henry Miles, both of Birmingham, for improvements in the manufacture of Venetian blinds and other window blinds, and in apparatus for raising and lowering the same.

1605. John Hirst, jun., of Dobcross, Saddleworth, and Enoch Openshaw Taylor, of Marsden, near Huddersfield, for improvements in means or apparatus for evaporating water and other fluids, and in economizing the use of steam.

1606. Richard Archibald Brooman, of Fleet-street, for improvements in circular looms or machinery for the manufacture of looped or knitted fabrics,—being a communication.

1607. John Henry Johnson, of Lincoln's-inn-fields, for improvements in the manufacture of tinned lead pipes, and in the apparatus employed therein,—being a communication.

1608. William Blackmore, of Foynes, Limerick, and Henry Lamb, of Ennis, Clare, for improvements in burning lime stone, and generating steam.

1609. James Allen Ransome, of Ipswich, for improvements in the manufacture of, and in fastening railway chairs with, wood trenails.

The above bear date May 28th.

1610. John Critchley, of Manchester, for an improved rib fastener for umbrellas and parasols.

1611. John Hirst, junior, of Saddleworth, and Joseph Wood, of Huddersfield, Yorkshire, for improvements in stereoscopic apparatus.

1612. Pierre Boissett and Bernardo Antognini, both of New York, for improvements in the manufacture of boots and shoes.

1613. Henning Boetius, of Great George-street, for a new mode of cooling (refrigerating) hot liquids and condensing steam.

1614. George Ashton, of Heywood, Lancashire, for improvements in dyeing fibrous substances, and in the means or apparatus employed for that purpose.

1615. James Denby Lee and James Crabtree, both of Shipley, near Bradford, Yorkshire, for improvements in looms for weaving.

1616. William Perks the younger, of Birmingham, for an improvement or improvements in metallic sash bars for windows, skylights, hothouses, and other like purposes.

1617. Charles Denton Abel, of Southampton-buildings, for improvements in apparatus for raising, propelling, or exhausting air, water, or other fluids or gases,—being a communication.

1618. Robert Griffiths, of Mornington-road, Regent's-park, for improvements in marine propellers for ships and boats, and for the sheathing of iron ships with metal sheathing to keep them from fouling.

1619. John Paterson, of Wood-street, for an improved hammer or instrument for turning over the edges of a binding or strip of linen or other material, and preparing it for stitching in sewing machines.

1620. William Clark, of Chancery-lane, for an improved method of throwing the shuttles of looms,—being a communication.

1621. Nathaniel Lawton and Robert Platt Whitworth, both of Stalybridge, for improvements in engines for carding cotton and other fibrous materials.

1622. Samuel Minton, of Isleworth, for an improved construction of revolving battery.

The above bear date May 29th.

1623. William Footman, of Great Queen-street, Westminster, for improvements in the treatment and use of sewage and liquid manures, and in reservoirs and pipes to be used therein.

1624. Florimond Datichy and Eugene Sabatier, both of Mortimer-street, Cavendish-square, for improved machinery and process for making pulp for the manufacture of paper and other purposes.

1625. Philippe Urbain Payras, of Paris, for improvements in protecting dry or green hides from vermin.

1626. James Gurrin, of Stroud, for a new mode of telegraphic communication between separate buildings or parts of buildings.

1627. Richard Nicholson, of Ripon, for improvements in the construction of lawn mowing machines.

1628. Isopy Léon, of Paris, for an improved curb or rein for enabling riders or drivers to stop restive or runaway horses.

1629. John Morrison, of Birmingham, for improvements in the construction of springs suitable for ladies' dresses or crinolines, and for chair, sofa, and other seatings, as well as for bedstead and couch sackings.

1630. Charles Octavius Staunton, of Paulton-square, Chelsea, for improvements in apparatus for signalling and indicating the position of shots on targets in rifle practice, and for preventing accidents to the markers.

1631. Henry Potter Burt, of Charlotte-row, Mansion House, for improvements in protecting wooden posts from decay; more particularly applicable to posts for supporting electric telegraph wires.

1632. Robert Churchyard Steed, of Aylesford-street, Pimlico, for improved apparatus for signalling on railways.

1633. Thomas Nathaniel Pengelly and William Byron, both of Charlotte-street, Whitechapel, for improvements in apparatus for hoisting goods.

1634. William Eddington, jun., of Chelmsford, for improvements in apparatus for draining and tilling land.

1635. Robert Emlyn Lofft, of Bury St. Edmunds, for improvements in small fire-arms and cartridges.

1636. Julius Ives, of New York, for

improved machinery for washing and wringing clothes or fabrics.

The above bear date May 30th.

1637. Alfred Gilbey, of Oxford-street, for improvements in the construction of packing cases or boxes for holding bottles either full or empty.

1638. John Henry Holland, of Lorimore-road, Surrey, for an improvement in traction engines.

1639. Godfrey Ermen and Robert Smith, both of Manchester, for certain improvements in machinery for spooling and balling sewing threads, silk yarn, and other like fibrous materials.

1640. William Thomas Smallwood, of Narrow-street, Limehouse, and William Wright, of Dean's-buildings, West India Dock-road, for improvements in water-closets.

1641. Alexis Moreau and Adolphe Ernest Ragon, both of Bernard-street, Russell-square, for improvements in electro-magnetic machines or apparatus.

1642. Theodore Vicomte de Veyre, of Paris, for a coating intended to protect iron from rust, and to preserve wood, cloth, paper, and pasteboard used for packing or roofing.

1643. Robert Shortrede, of Brighton, for improvements in presses for pressing cotton and other articles.

1644. David Alexander Lamb, of Berwick-upon-Tweed, for improvements in railway buffers, or apparatus to relieve concussions on railways.

1645. Henry Watson, of Newcastle-upon-Tyne, and Joseph Millbourn, of Dartford, for improvements in pulp strainers or knotter bottoms.

1649. George Calley Lingham and Joseph Nicklin, both of Birmingham, for an improved crinoline connector and suspender.

1650. Leopold Chaubart, of Moissac, France, for an improved mode of, and apparatus for, raising the level of water in rivers, canals, and other water courses.

1651. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the treatment of cloth and other textures, leather, or animal tissues, for the purpose of rendering them more durable and impermeable to water and other fluids; and for producing from any firm fibrous texture, such as cloth, cotton, woollen, or mixed goods, a durable artificial leather,—being a communication.

1652. William Kirby Sullivan, of Rathmines, Dublin, for improvements in the preservation of stone, plaster, cement, and other like matters; the invention being likewise applicable to the manufacture of artificial stone, and to the fixation and production of colors on, and in the body of, stone, plaster, or cement.

1653. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the construction and operation of shot-proof gun towers, and the working of the guns therein, for sea vessels, floating harbour defences, forts, or land fortifications,—being a communication.

The above bear date May 31st.

1654. Benjamin Templar, of Manchester, for improvements in apparatus for registering and indicating billiards and other games.

1655. James King and John Partington, both of Rochdale, for certain improvements in looms for weaving.

1656. John Elce and William James Gradwell, both of Manchester, for certain improvements in machinery for spinning, doubling, and winding cotton and other fibrous substances.

1657. Antoine Joseph Sax, of Paris, for improvements in kettle, big, or other drums.

1658. Thomas Campbell, of Leeds, for improvements in apparatus for "witneying" piled fabrics.

1659. Carl Heinrich Roeckner, of Bristol, for an improved method of constructing coffer dams and other similar structures, for excluding or keeping back the flow of water and preventing inundations.

1660. Joseph Baker, of Coatbridge, Lanarkshire, N.B., for improvements in pumps.

1661. John Key and Ferdinand Potts, both of Birmingham, for certain means of producing designs in iron, and in the application of the same, or designs formed in like manner of

other metals, to the manufacturing and ornamenting of bedsteads and other metal articles of furniture.

1662. Carroll Eugene Gray, of Great Suffolk-street, Southwark, for improvements in apparatus for extracting, rendering, receiving, purifying, cooling down, and delivering oleaginous and fatty matters, or other material treated by steam pressure for extraction.

1663. Joseph Whitworth, of Manchester, for improvements in shells.

1664. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for an improved mode of making the handles of shovels, spades, dung forks, and other analogous articles,—being a communication.

1665. Edward Lloyd, of Bow Paper Mills, for improvements in machinery for the manufacture of paper.

1666. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improved machinery for breaking and cleaning flax and other like fibre-yielding plants,—being a communication.

1667. John Marson, of Birmingham, for a new or improved projectile for small arms and ordnance of every description.

1668. John James Henry Gebhardt, of Lawrence-lane, for an improved fastening for bags, purses, and other similar articles,—being a communication.

The above bear date June 2nd.

1669. Thomas Layzell Scowen, of Allen-road, Stoke Newington, for improvements in indicating time and accent in music.

1670. Goldsworthy Gurney, of Bude, Cornwall, for improvements in apparatus for production and application of artificial light.

1671. William Hatherton Hall, of Birmingham, for improvements in miners' safety lamps.

1673. John Biers, the younger, of Tottenham-court-road, for improvements in shoes for horses and other animals.

1674. Stringer Weston, of Tenterden, Kent, for improvements in trusses.

1675. James Lee Norton, of Belle Sauvage-yard, for improvements in machinery for raising and forcing water.

The above bear date June 3rd.

1677. Archibald Hewisson Perry, of Brighton, for improvements in fastenings for, and in the method of fastening together or securing, railway chairs and sleepers, and for other similar purposes.

1678. George Peel, jun., and Joseph Simpson, both of Manchester, for improvments in the construction, arrangement, and mode of working hydraulic presses, and in the arrangement of force pumps.

1679. Charles Staunton Cahill, of Gerrard-street, Islington, for improvements in the manufacture of felted fabrics, suitable for hats, bonnets, and other purposes.

1680. William James, of Dudley, for improvements in bolts, spikes, and nails, and in apparatus for their manufacture.

1681. Thomas Alcock, of Ratcliffe-on-Trent, Nottingham, for improvements in the construction of horse rakes.

1682. Richard Roe, of York, for improvements in planes for tongueing, working sash fillisters, or other similar purposes.

1683. George Allibon and Edward Snell, both of Lewisham, for improvements in surface condensers and super-heaters.

1684. Giovanni Battista Toselli, of Threadneedle-street, for improvements in apparatus for freezing and cooling liquids and mixing syrups.

1685. Isaac Battinson and George Battinson, both of Halifax, Yorkshire, for improvements in machinery for combing wool and other fibres.

1686. George Henry Sanborn, of Boston, U.S.A., for improvements in refrigerators,—being a communication.

1687. Frederick Philip Preston, of Counter Hill, New Cross, and Charles Goodman, of Deptford, for improvements in the permanent way of railways.

1688. Edward Scheutz, of Brompton, for improvements in rotatory engines.

1689. Samuel Huston, of Deeping,

Saint James, Lincolnshire, for improvements in safety valves.

1690. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the construction of grain and grass harvesters,—being a communication.

1691. Edward Conroy, of Boston, U.S.A., for improved machinery for cutting corks, bungs, and such like articles.

The above bear date June 4th.

1692. George Rydill, of Wardrobe-place, for an improved hydraulic pump or engine for raising liquids and obtaining motive power; also applicable for the ventilation of mines and other useful purposes.

1693. Joseph Emile Moiroux, of Windmill-street, Tottenham-court-road, for a new compound for protecting and preserving the polish, polished and other surfaces of metals, woods, skins, and paper; and for rendering all woven textile and other fabrics water and weather proof.

1694. James Bell, of Portobello, Midlothian, N.B., for improvements in fastenings for railway chairs.

1695. Robert Robinson, of Hull, for improvements in fire-escapes; parts of which improvements are also applicable to other purposes.

1696. John Martin Stanley and Jabez Stanley, both of Sheffield, for improvements in stoves or apparatus for diffusing heat.

1697. John Keatley and James Tangye, both of Birmingham, for an improvement or improvements in lifting jacks.

1698. Richard Sill, the younger, of Birmingham, for an improved method of attaching direction cards, name plates, or other cards or plates to trunks, packing cases, and other articles.

1699. Perceval Moses Parsons, of Blackheath, for improvements in ordnance, and in tools for rifling the same; parts of which improvements are applicable to small arms.

1700. William Rowe, of East India-road, for an improved forge and bellows.

1701. Edward Conroy, of Boston, U.S.A., for improved machinery for cutting corks, bungs, and such like articles.

1702. George Hadfield, of Liverpool, for improvements in the manufacture of casks or barrels, and in the machinery and apparatus to be used in the construction of the same.

1703. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the construction of organs and other wind instruments; parts of which improvements are also applicable for regulating the pressure and flow of gas and air,—being a communication.

The above bear date June 5th.

1704. James Verity, of Carlton-road, Kentish-town, for an improved composition for coating and preserving walls or other exposed surfaces.

1705. Ephraim Death, of Leicester, for improvements in road locomotives or traction engines.

1706. George Darlinson, of Coventry, for improvements in the manufacture of ribbons.

1707. William Richard Jeune, of Bow, for improvements in the manufacture of fabrics suitable to be used as substitutes for solid leather.

1708. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improvements in knitting machinery,—being a communication.

The above bear date June 6th.

1710. Arthur John Adams, of Devonport, for an improved method of rifling fire-arms.

1711. George Darbyshire Hatton, of Manchester, for improvements in presses.

1713. Charles Hook, of Bridgewater, for improvements in the construction of steam engines.

The above bear date June 7th.

1714. James Lovegrove, of Dalston-lane, Hackney, for improvements in apparatus for inspecting small sewers and drains, and for facilitating the removal of obstructions therein.

1715. William Henry Turner, of Blackburn, for improvements in engines for carding cotton and other fibrous materials.

1716. Alfred Ford, of the Priory, Battersea, for an improved method of

protecting beer and other fluids from the direct action of atmospheric air.

1717. Edouard Hottin, of Paris, for a composition for rendering uninflammable linen, flax, silk, cotton, woodwork, and other articles or materials.

1718. John Keeling, of Reading, for improvements in apparatus for the manufacture of gas.

1719. Joseph Marie Ryo-Catteau, of Paris, for improvements in machinery for twisting wool, cotton, flax, silk, and other fibrous threads.

1720. Charles William Heckethorn, of St. Ann's-road, Brixton, for improved apparatus for obtaining and applying motive power.

1721. Fernando Giachosa, of Warwick, for improvements in ventilating mines, ships' holds, and other places.

1722. Arthur John Joyce, of Cambridge-terrace, for improvements in lighting and heating.

1723. Arthur Knowles, of Birstal, near Leeds, for improvements in apparatus for washing extracted wool and other fibre.

The above bear date June 9th.

1724. William Smith, of Salisbury-street, Adelphi, for improvements in photography,—being a communication.

1725. Thomas Lister, of Hipperholme, near Halifax, for improvements in the material to be employed for address cards, visiting cards, labels, railway tickets, and other similar articles, whether for printing or writing upon.

1726. John Kinlock and Thomas Edmeston, both of Preston, Lancashire, for improvements in looms for weaving.

1727. John Anthony Pols, of Nye's Wharf, Old Kent-road, for an improved method of refining oils.

1728. Nathan Davis, of The Cedars, Putney, for an improved propeller for ships or vessels.

1729. George Thomas Jourdain, of St. Paul's-terrace, Canonbury, for improvements in treating cocoa-nut oil.

1730. Henry Constantine Jennings, of Great Tower-street, for improvements in the preparation of skins for driving bands and harness traces.

1731. John Alison, of Reigate, for improvements in harrows, and in the apparatus for steering or guiding of such, and other agricultural implements.

1732. John Brouncker Ingle, of King William-street, for improvements in reaping and mowing machines,—being a communication.

1733. John George Appold, of Wilson-street, Finsbury-square, for improved apparatus for regulating the discharge of water and other liquids, and air and other gases.

The above bear date June 10th.

1734. James Shand and Samuel Mason, both of Blackfriars-road, for improvements in the construction of steam boilers.

1735. William Lennan, of Dublin, for an improved safety stirrup.

1736. John Davis Wake, of Cornhill, for improvements in the construction of ships and vessels.

1737. Henry Bland, of Luton, Bedfordshire, for improvements in sewing machines.

1738. William Holland, of Adelphi Mills, Salford, for certain improvements in carding engines.

1739. William Crook, of Blackburn, for improvements in looms for weaving.

1740. David Crichton, William Donbavand, and Duncan Crichton, all of Manchester, for improvements in looms for weaving.

1741. John Marsh, of New Sneinton, near Nottingham, for improvements in the manufacture of lace, and in the machinery employed therein.

1742. John Henry Johnson, of Lincoln's-inn-fields, for improvements in cradles or swing cots,—being a communication.

1743. Balthasar Wilhelm Gerland, of Newton-le-Willows, for improvements in the manufacture of sulphate of copper, and in obtaining metals from the material used in such manufacture.

1744. Joseph Ellicott Holmes, of South-parade, Chelsea, for improved machinery for cultivating or harrowing land,—being a communication.

1745. John Hetherington, of Manchester, for improvements in lubricating revolving surfaces.

The above bear date June 11th.

1746. John Ingham and William Pickard Wood, both of Bradford, Yorkshire, for improvements in preparing coloring matters for dyeing and printing.
1747. Isaac Spight, of Glandford Briggs, Lincolnshire, for improvements in horse shoes.
1748. Frederick Tolhausen, of Paris, for a new or improved surgical injecting apparatus,—being a communication.
1749. Auguste Aimé Lerenard, of Paris, for a new and improved cement or mastic for making joints of steam, water, or gas pipes or chambers.
1750. Henry Stockton Firman and William James Williams, both of Great Suffolk-street, Southwark, for improvements in apparatus for cutting up and preparing, as food or chaff for animals, or for any other purpose, straw, hay, corn stalks, roots, and all other similar substances,—being a communication.
1751. Henry Stockton Firman and William James Williams, of Great Suffolk-street, Southwark, for improvements in lamps; more particularly designed for burning paraffin or coal oil, and other hydro-carbons of different grades, or any combustible material used for obtaining light,—being a communication.
1752. Antoine Salviati, of Venice, for an improved mode of producing indestructible inscriptions and ornamental surfaces in gold and other precious metals,—being a communication.
1753. Benjamin George, of Kingsland-road, for improvements in the construction of portable beds, bolsters, pillows, and sofa and other cushions.
1754. Michael Jackson, of Curtain-road, Shoreditch, for an improved shield for the gums, to protect them from injury when cleaning the teeth.

The above bear date June 12th.

1755. William Smith, of Leeds, for improvements in apparatus for cutting or dividing soap.
1756. George Haseltine, of Fleet-street, for improvements in the construction and application of rails for railways,—being a communication.
1757. Abram Longbottom, of Hammersmith, for improvements in the manufacture of artificial stone.
1758. John Wilson, of Albert-square, Clapham-road, for improvements in the construction of ships for war purposes; applicable also to the mercantile marine.
1759. John Henry Glew, of Howland-street, Fitzroy-square, for improvements in sewing machines.
1760. Clara Ann Tyler, of Birmingham, for a new or improved holder for holding dinner and other plates and dishes, and for other like purposes.
1761. Thomas Willis Fleming, of Lancaster-gate, Bayswater, for improvements in preparing charges for fire-arms.
1762. John Bermingham, of Cork, for improvements in the construction of vessels of war; parts of which improvements are also applicable to the construction of vessels for commercial and other purposes.
1763. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in fire-arms, and in the attachment of bayonets or swords thereto,—being a communication.
1764. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for an improvement in elongated bullets,—being a communication.
1765. Julius Ives, of New York, for improved apparatus for expressing juice from fruit and other vegetable substances.

The above bear date June 13th.

1768. Thomas Williams, of Red Lion-street, Clerkenwell, and Henry Cox, of Lower-street, Islington, for improvements in churns; partly applicable to washing machines.
1769. Joseph Sawyer, of Noble-street, and George Padgham, of Dalston, for improvements in steam boiler and other furnaces; applicable in part to grates of various kinds.

1770. Jules Germain Alexandre Dallot, of L'Isle Adam, Seine et Oise, France, for a new portable circular saw.
1772. John Henry Johnson, of Lincoln's-inn-fields, for improvements in jacquard machines,—being a communication.
1773. William Bouch, of Shildon, Durham, for improvements in cranes.
1774. Richard Archibald Brooman, of Fleet-street, for improvements in coking ovens, in collecting and utilizing the products resulting from the distillation or carbonization of coal and other matters producing coke, and in apparatus employed therein,—being a communication.
1775. William Wighton, of Edinburgh, for improvements in apparatus for regulating watches and other timekeepers.
1776. Robert Hicks, of Kensington Park-terrace, for improvements in the manufacture or preparation of paints, pigments, and colours.

The above bear date June 14th.

1777. Charles Edme Courtillier, of Paris, for improved inhaling and saturating apparatus.
1778. François Marie Lanoa, of Paris, for an improved geodetic or topographic instrument, intended to combine in one all the instruments now used in surveying.
1779. John Fleming Allan, of Glasgow, for improved furnace arrangements to prevent smoke and economize fuel.
1780. George Henry Birkbeck, of Southampton-buildings, for improvements in the construction of presses for extracting liquids from various substances,—being a communication.
1781. James Evans, of Hyde, Cheshire, for improvements in self-acting mules.
1782. William Joseph Curtis, of Tufnell Park-road, Holloway, for an improvement in the construction of screw propellers.
1783. Henry Bright, of Woodford, for improved apparatus or arrangements for screening fires in stoves and grates, with the view to avoid accidents.

The above bear date June 16th.

1784. Joseph Ellicott Holmes, of South-parade, Trafalgar-square, Chelsea, for improved machinery for digging or cultivating land,—being a communication.
1785. Samuel Hazard Huntly, of Upper Baker-street, Regent's-park, for improvements in the construction of furnaces for effecting the more perfect combustion of the fuel.
1786. Andrea Crestadoro, of Genoa, for improvements in obtaining and applying motive power from rarefied air and from aeriform fluids.
1787. John Hunt, of Birmingham, for an improvement or improvements in bronzing or colouring articles of copper or alloys of copper.
1789. Alexander Woodlands Makinson, of Westminster, for improvements in locomotive and stationary engines.
1790. John Nield and Thomas Arthur Nield, both of Dukinfield, for improvements in moulding or manufacturing pipes, columns, or other similar articles, of cast iron or other metals.
1791. Archibald Pringle, of Gloucester-crescent, Camden Town, for certain improvements in locks.
1792. Mansfield Turner, of Wigston, Leicestershire, and Edward Thomas Loseby, of Leicester, for improvements in small arms and ordnance, and in sights for the same; part of which may be used for measuring distances.
1793. Samuel Varley, of Sleaford, for improvements in reaping machines.
1794. William Clark, of Chancery-lane, for improvements in the manufacture of buttons, and in apparatus for the same,—being a communication.
1796. Joseph Kellow and Henry Short, both of Delabole, Cornwall, for improvements in the manufacture of blasting powder.

The above bear date June 17th.

1798. John Henry Johnson, of Lincoln's-inn-fields, for improvements in projectiles,—being a communication.
1799. Joseph Warren, of Maldon, Essex, for improvements in ploughs.
1800. Francis Coltman, of Normanton, for improvements in apparatus for

discharging coals, minerals, or other substances.

1801. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in electrical brushes,—being a communication.

The above bear date June 18th.

1802. William Clark, of Quadrant-road, Highbury New Park, for improvements in the manufacture of that kind of boxes known as dry goods boxes.

1803. John Lancelot Smith, of Saint John-square, Clerkenwell, for a universal fire alarum, with discharging apparatus.

1804. George Speight, of Saint John-street-road, for an improvement in the manufacture of head ornaments.

1805. Andrew Howat, of Farnworth, near Bolton-le-Moors, for improvements in the construction of water gauges and blow-off taps for steam boilers, and other purposes.

1807. William Stokes, Charles Wedge James, and John Stokes, all of Birmingham, for a new or improved machinery for stocking and screwing guns and pistols.

1808. Richard Stansfield and John Dodgeon, both of Todmorden, for improvements in looms for weaving.

1809. Charles Cartwright, of Liverpool-street, Moorfields, for improved means of stopping or retarding trains on railways.

1810. Montague Wigzell, of Topsham, Devonshire, for improvements in the form of bolts and other fastenings for shipbuilding and other purposes.

1811. Edward John Davis, of West Smithfield, for improvements in treating and preparing food for horses and other animals.

1812. John Bland Wood, of Broughton, near Manchester, for improvements in the manufacture of driving straps or bands, the backs of wire cards and cop tubes.

1813. William Thomson, of Thorney, near Peterborough, for improvements in machinery for making bricks, tiles, and other articles.

The above bear date June 19th.

1814. William Jeffries, of West Bromwich, for a new or improved rail for railways, and a new or improved chair or sleeper for the said rail.

1815. Joseph Gustave Dupuch, of Paris, for improvements in cocks for regulating the supply of gas.

1817. William Edward Gedge, of Wellington-street, Strand, for improvements in the manufacture of candlesticks, and in machinery or apparatus used in such manufacture,—being a communication.

1818. John Bedford, of Paris, for improvements in the irons and cutters of planes, and in the method of manufacturing the same,—being a communication.

1819. William Malins, of Pershore, Worcestershire, for an improved protective covering for agricultural or other similar purposes.

1820. Daniel Adamson, of Newton Moor, Cheshire, and Levi Leigh, of Saint Petersburgh, for improvements in the construction of steam boilers, and in apparatus connected therewith; part of which is applicable to ship building.

1821. Bomanjee Muncherjee Mody, of Trafalgar-square, for improvements in varnish or polish.

1822. Joseph Walter Taylor, of Newsome, near Huddersfield, for improvements in valves, and in means for regulating and indicating the flow and pressure of fluids.

1823. David Middleton, of Burton-by-Lincoln, for improvements in cranes for lifting weights into and out of carts, and for other purposes.

1824. Charles Osman, of Chryssell-road, Brixton, for improvements in the manufacture of elastic or yielding surfaces, for sitting, lying, or reclining upon; parts of which improvements are applicable to other purposes.

1825. Arthur Warner, of Threadneedle-street, for improvements in the manufacture of pigments or paints from certain refuse materials.

1826. George Gray and David Cunningham, both of Whiteburn, Linlithgow, N.B., for improvements in applying a new material to be used as a substitute for the "blackening" or other materials employed in casting or moulding metals.

The above bear date June 20th.

1828. François Eugène Schneider, of Paris, and Jacob Snider, junior, of the United States of America, for improvements in the construction of breech-loading fire-arms.

1830. James Taylor, of Oldham, for an improved "doffer" or "stripper" for carding engines for preparing cotton and other fibrous substances.

1831. George Simpson, of Glasgow, for improvements in machinery for working, boring, and mining or excavating tools, and mine and other pumps.

1832. Henry Davenport and John Davenport, both of Bradford, Yorkshire, for improvements in means or apparatus for the manufacture of loom healds or harness.

1833. John Anderton, of Accrington, for certain improvements applied to the tape-leg or sizing machine, and in the apparatus employed therein, for the purpose of improving the yarn.

1834. Stephen Holman, of Cannon-street, for improvements in pumps and valves.

1837. John Hooper Redstone, of Indianapolis, Marion county, U.S.A., for improvements in the construction of boilers of steam engines,—being partly a communication.

1838. Frederick Tolhausen, of Paris, for improvements in apparatus for preventing collisions on railways,—being a communication.

1840. John Lawson, of Glasgow, for improvements in the manufacture of carpets and other piled fabrics.

1841. Ezekiel Edmonds, of Berryfield, Wiltshire, for improvements in the manufacture of felted articles and fabrics, and in the apparatus employed therein,—being partly a communication.

The above bear date June 21st.

1842. Thomas Wilson, of Birmingham, for a new or improved dress fastening; which said fastening is also applicable to the fastening of bands and belts in general, and to other like purposes.

1843. Hugh McKenzie and Patrick Ramsay, both of Glasgow, for improvements in cylindrical or circular brushes or rollers for various manufacturing machines.

1844. Henry Ponsonby, of Liverpool, for improvements in top sail sheet bits or bolts.

1846. Alexander Webster, of Arbroath, Forfarshire, for improvements in machinery or apparatus for boring slate.

1847. William Barr, of Coventry, for an improved manufacture of raised or brocaded fabrics woven in cotton or flax, either alone or in combination with wool.

1848. Richard Cook, of Finsbury-place South, for improvements in the construction of pianoforte actions.

The above bear date June 23rd.

1849. Abraham Ripley, of Brook-street, Lambeth, for improvements in the construction of damper governors or regulators.

1850. William Hargreaves and George Henry Leather, both of Bradford, Yorkshire, for improvements in machinery or apparatus for combing wool, hair, silk, cotton, flax, and other fibrous substances.

1851. Thomas Carr, of New Ferry, Cheshire, for an improved machine for grinding, kneading, washing, and other like purposes.

1852. Theophile Desgrandschamps, of Paris, for a new mechanism of distribution with motion from the rod, applicable to any kind of steam engines.

1853. George Collier, of Halifax, and James William Crossley, of B[illegible]-house, for improvements in means or apparatus for hot-pressing; which improvements are also applicable to other heating purposes.

1854. William Bayliss, of Wolverhampton, for an improved strainer for straining and tightening wire for fencing and other purposes.

1856. George Gray, of Greenwich, for improvements in the manufacture of wheels.

1857. Edward Chambers Nicholson, of Locksfields, Surrey, for improvements in the preparation of colouring matters applicable to dyeing and printing.

1858. William Clark, of Chancery-lane, for improvements in hernial and other orthopedic apparatus, and

in pessaries and other instruments,—being a communication.

The above bear date June 24th.

1859. Marc Antoine François Mennons, of Paris, for improvements in steam-boiler furnaces,—being a communication.

1860. Samuel Brooks, of Manchester, and Samuel Denton, of Oldham, for improvements in machinery for spinning and doubling.

1861. John Blair, of Manchester, for improvements in the manufacture of wadding.

1862. William Clark, of Chancery-lane, for improvements in ploughs,—being a communication.

1863. George Haseltine, of Fleet-street, for improvements in vaporizing lamps for burning petroleum or coal oil,—being a communication.

1864. Frederick Tolhausen, of Paris, for an improved lock or locking apparatus,—being a communication.

1865. Abraham Bayley, of Liverpool, for improvements in lamps.

1866. Christian Collett Steenstrup, of Horten, Norway, for an improved economical can or vessel for containing and delivering lubricating or other fluids.

1867. Edward Heinson Huch, of Brunswick, and Francis Joseph Windhausen, of Duderstadt, Hanover, for improvements in caloric engines, named "fire-air engines."

1869. George Turner, of Rose-terrace, Brompton, for improvements in mincing apparatus; such improvements being also applicable to machines for grinding coffee and spices.

1870. Justin David, of Paris, for an improved dynamometer for ascertaining the relative strength and elasticity of various kinds of threads and ropes.

1871. William Clark, of Chancery-lane, for an improved frame for holding photographic pictures,—being a communication.

1872. William Clark, of Chancery-lane, for improvements in apparatus for raising the nap on cloth and other fabrics,—being a communication.

The above bear date June 25th.

1874. George Peterson, of Brompton-square, for improvements in apparatus for ascertaining the quantity and strength of spirits or other products obtained by the process of distillation,—being a communication.

1875. Thomas Rainforth Tebbutt, of Manchester, for certain improvements in the manufacture of soap, soda, and other material employed for the purpose of washing and cleansing.

1876. John Parks, of London-street, Paddington, for improvements in gas lanterns.

1877. Jean Benjamin Coquatrix, of Paris, for improvements in weaving carpets, tapestry, and similar fabrics, and in apparatus for the same.

1879. John Henry Johnson, of Lincoln's-inn-fields, for improvements in the construction of electro-voltaic plate work for medical and other purposes,—being a communication.

1880. John Henry Johnson, of Lincoln's-inn-fields, for a new composite fluid to be used for illuminating purposes,—being a communication.

The above bear date June 26th.

1881. Alexander Anderson, of Saint John's, New Brunswick, for improvements in apparatus for steering ships or other vessels.

1882. John Watson, of the Old Bailey, for improvements in printing machines, and apparatus connected therewith for printing from letter-press forms.

1883. Charles Cochrane, of Middlesborough-on-Tees, for improvements in the manufacture of aluminate of soda and potash.

1884. Edward Hunt and Henry Davis Pochin, both of Salford, for an improved condensing apparatus.

1885. Charles Cochrane, of Middlesborough-on-Tees, for improvements in the manufactnre of iron.

1886. Josiah Lord, of Todmorden, and John Brown, of Burnley, for certain improvements in power-looms for weaving.

1887. William Owen, of Coventry, for the manufacture of woven tickets of silk, cotton, or wool, or mixtures of those materials, for the purpose of marking or advertising goods.

1888. Richard Archibald Brooman, of Fleet-street, for a method or methods of preparing paper for the reception of photographic pictures or impressions, in order that the said pictures or impressions may be transferred to and fixed on wood, porcelain, and other surfaces,—being a communication.

1889. Alexander Hennah Martin, of Buttershaw, near Bradford, for improvements in means or apparatus employed in weaving.

1890. Isaac Holden, of Bradford, for improvements in means or apparatus for preparing and combing wool and other fibrous materials.

1891. Alexander Angus Croll, of Coleman-street, for improvements in the treatment of ammoniacal gas liquor of gas works.

The above bear date June 27th.

New Patents Sealed.

1861.

3190. O. C. Evans.
3193. George Walkland.
3194. William Tipple.
3199. E. E. Pereau.
3200. Robert Wailes.
3203. D. C. Le Souef.
3205. T. Morris, R. Weare, and E. H. C. Monckton.
3207. Filippo Grimaldi.
3211. Fraser Selby.
3212. William Kempe.
3215. L. R. Bodmer.
3216. Charlotte Smith.
3217. John Rosindell.
3218. Charlotte Smith.
3220. J. F. Harvey.
3228. T. Simmons and T. Timmins.
3229. Jabez Jones.
3230. Thomas Standing.
3234. James Shepherd.
3235. Richard Needham.
3237. J. N. Palmer.
3239. Thomas Silver.
3240. P. A. Le Comte de Fontainemoreau.
3241. P. A. Le Comte de Fontainemoreau.
3242. Thomas Bright.
3243. T. W. Atlee.
3246. R. A. Brooman.
3251. Michael Henry.
3255. James Gordon.
3258. J. B. Payne.
3264. N. McHaffie.
3267. William Spence.
3268. John Haslam.
3274. E. T. Hughes.
3275. R. A. Brooman.
3276. A. and J. Edward.

1862.

2. N. C. Szerelmey.
3. J. H. Johnson.
5. John Walker.
6. T. C. Clarke.
8. R. A. Brooman.
11. Benjamin Rhodes.
13. W. B. Patrick.
14. E. F. Davis.
20. W. A. Fell.
22. George Jeffries.
25. Gilbert Stracey.
26. F. S. Belloche and H. Bollack.
27. W. E. Gedge.
28. J. W. Arundell.
34. James Howden.
37. Arthur Warner.
39. A. V. Newton.
40. G. Betjemann, G. W. Betjemann, and J. Betjemann.
43. Frederick Brown.
44. Frederick Shaw.
45. J. Higgins and T. S. Whitworth.
46. John Tatham.
48. A. Wallis and C. Haslam.
51. Anthony Heath.
53. C. and T. Pilkington.
55. John Stenhouse.
56. Henry Bessemer.
57. William Bradshaw, junior.
58. Henry Cook.
59. C. W. Siemens.
60. J. Smith and S. Wellstood.
63. David Wilson.
65. David Wilson.
67. R. A. Brooman.
68. Benjamin Thompson.
71. John Carter.
72. Robert Johnson.
73. Montague Wigzell.
75. James Oates.
77. W. H. Preece.
83. Joseph White.
85. Thomas Scott.
89. T. and C. Gilbert and T. Haddon.
90. F. C. Warlich.
91. T. Soar, J. Belshaw, and M. Soar.
92. J. Parker, J. Wells, and B. Wells.
94. R. A. Brooman.
102. E. W. Hughes.
107. S. W. Marsh.
108. T. Harrison and J. G. Harrison.

109. Christopher Hill.
113. William Cleland.
114. Thomas Timmins and Thomas Simmons.
115. Joseph Ridsdale.
116. H. D. P. Cunningham.
118. J. A. Knight.
119. E. H. C. Monckton.
123. T. and E. Meyers.
125. J. M. Rowan.
129. Robert Romaine.
130. John Tow.
131. T. Emmott and J. Travis.
135. J. J. Stevens.
137. Samuel Dreyfous.
139. T. Roberts and J. Dale
140. W. S. Mappin.
141. Leonard Barbat.
143. T. W. Jobling.
144. William Bodler.
145. A. Lamb and J. White.
146. Joseph Bird.
147. E. C. Nicholson.
149. R. O. Doremus and B. L. Budd.
150. John Stenhouse.
153. Christopher Binks.
155. H. B. Barlow.
156. G. T. Bousfield.
157. J. H. Rawlins.
158. A. J. Martin.
159. R. A. Brooman.
160. William Burgess.
161. Michael Henry.
163. Louis Martin.
164. Isaac Roberts.
165. F. W. Gerish.
166. Edmund Pace.
167. A. J. Beer.
172. John Wallace.
[illegible]. W. H. Ropes.
[illegible]5. Henry Owen.
178. Abraham Ripley.
182. James Higgin.
183. J. Cornforth and B. Smith.
184. William Clark.
185. John Longhurst.
195. J. C. F. Mougin.
203. Alexander Samuelson.
205. Joseph Lillie.
218. M. A. F. Mennons.
220. A. H. Church.
228. R. Bodmer and W. Wilson.
235. William Clark.
239. W. E. Newton.
246. E. A. Rippingille.
250. William Clark.
259. W. and F. Walton.
270. Leon Fauvel.
276. Thomas Cook.
279. William Clark.
281. M. A. F. Mennons.
283. David Joy.
287. W. E. Newton.
291. C. M. Roullier.
304. Henry Ashworth.
316. Michael Henry.
318. E. T. Bellhouse and W. J. Dorning.
338. M. A. F. Mennons.
386. J. F. Lawton and J. Lawton.
388. W. D. Allen.
403. Thomas Renison.
438. James Nasmyth.
449. G. F. Lee.
494. Thomas Partridge, senior.
500. James Woodrow.
573. Pierre Remond.
635. F. R. Newton and H. Codd.
644. A. C. MacLeod.
650. H. H. Kromschweder.
689. E. T. Hughes.
697. W. E. Newton.
712. William Clark.
719. John Grant.
720. H. Y. D. Scott.
735. Brereton Todd.
736. William Borford.
755. J. A. Jaques, J. A. Fanshawe, and F. Jaques.
759. Fredrick Warner.
810. Thomas White.
818. M. A. F. Mennons.
870. Robert Lublinski.
893. J. P. Woodbury.
914. J. H. Johnson.
928. A. V. Newton.
929. W. E. Gedge.
967. W. E. Newton.
1003. John Lawson.
1012. William Davies.
1015. Colin Mather.
1028. G. D. Mertens.
1040. J. T. Grice.
1070. John Dargue.
1113. J. W. Forde.
1164. J. C. Amos.
1173. George Scoville.
1187. A. V. Newton.
1190. C. E. Heinke.
1199. J. F. Allen.
1304. A. V. Newton.
1308. Joseph Tyler.
1340. J. H. Johnson.
1342. Benjamin Cooke.
1343. Thomas Cabourg.
1422. J. H. Johnson.
1439. Gideon Blake.
1505. E. J. Bridell.
1535. Alfred Giles.

**** For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.*

NEWTON'S
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No. XCIII. (NEW SERIES), September 1st, 1862.

The International Exhibition.

DECORATIVE ART.—III.

Silver and Plated Goods.

It is frequently very difficult to account for the decided superiority possessed by one nation over another in some branch of the arts or manufactures; but the reason is still less obvious, why, in the same country, one class of artizans, enjoying all the advantages of their fellows in a kindred branch of industry, should be so thoroughly outstripped by them, as to render their laborious conceits apt subjects for ridicule and contempt. Some may, perhaps, doubt that progress in the arts can be effected in so halting a manner, yet if any candid investigator will compare the wrought iron and brass work of the Exhibition (which is almost wholly English) with the work of the English silversmiths, he will see a striking contrast between these two branches of decorative art. In the charming works in brass and iron, already specially noticed in these papers, there is not merely the indication of thought, but a successful realization of artistic fancy, constrained by manipulative and structural requirements, carrying us back in thought to the best times of the old mediæval metal workers; whereas, in the gorgeous display of silver, will be found, for the most part, great technical skill directed to an objectless purpose,—proving an utter impotence of imagination in the designers employed. This cannot be because the ability to design is not forthcoming, for it is equally easy to design appropriately for silver utensils as for iron gates or brass lecterns; neither can the cost of obtaining competent assistance stand in the way of the silversmith, since the remuneration of the artist would figure at a far less per centage on the cost of a silver vase, than on that of a wrought iron screen. Some other reason must, therefore, be sought for the manifest inferiority of design which we have alleged to exist in the works selected for exhibition by our wealthy silversmiths, as worthy examples of their highest efforts. Before, however, we seek to ascertain the cause of the degradation of the art of working in precious metals, it will be well to draw attention to the contributions which have been brought together for our admiration, and ascertain what are their leading characteristics. The first

impression one gets is, that utility plays a very subordinate part indeed in this class of art manufacture. There is, therefore, one would think, more need for some palpable expression of poetic or artistic feeling. Centre-pieces, whose sole duty is, not unfrequently, to fill a blank space at a sumptuous banquet, appear to be the leading favourites with buyers of this class of manufacture; but when of inferior size, they are often needed to do duty either as epergnes or candelabra. When, however, they are intended to administer solely to the pride of their possessor and the admiration of his guests, there is free scope for the designer's fancy, the only requirement being that a good elevation shall be ensured. Let us now see how the artists have availed themselves of this freedom: Messrs. Garrard's case in the nave affords an example of a centre-piece glorying in all the beauty of frosted and burnished silver, and consisting of a mounted officer of artillery, and man, standing by a field-piece. There is no action and no composition other than that which a child would show in arranging his toys; yet the work evidences, perhaps, as much technical skill or mastery over the metal, as would suffice for a Benvenuto Cellini. To estimate the value of this centre-piece aright, it is only necessary to weigh it, and multiply the number of ounces with the market price of silver. Messrs. Elkington and Co. show a candelabrum, composed of Indian forest trees, the stems of which form the supports for the sconces, and provide a refuge also for some wild beast, which is acting its part in some thrilling jungle incident (the exact nature of which we are unable to discern), and is being fiercely attacked by native Indians. To take another example: Messrs. Hunt and Roskell show, in their case under the eastern dome, a centre-piece, executed for the Earl of Stamford, the design of which, for want of a better name, we will call "The Death Struggle." The scene is a rock, overhanging a rough piece of fern land, and forming an elevated platform for the combatants—two deer—who are in mortal conflict. Two stunted tree trunks rise out of the rock, and form a background to the combatants, while on the plain below, like sentinels on duty, stand the remainder of the herd, regardless of the struggle that is going on above. What the intention of the designer of this impossible scene can have been, is to us a mystery, and still more puzzling is it to understand, that such a meaningless and costly labour should find a purchaser; for fine art this work is not, and to decorative art it makes no pretension. Another centre-piece by the same manufacturers, in which Britannia, surrounded by trophy flags, forms the crowning feature, may, perhaps, pass muster as an allegorical design, though, to us, it conveys no meaning, although three soldiers on prancing steeds, doing duty at the base, are evidently intended to assist the spectator to the artist's meaning. The so-called "Ascot Cup" for

1861, also from the same manufactory, is a far better example, composed, as it mainly is, of some features of decorative art suitable for silversmiths' work.

It is very singular that the public should ever have tolerated a class of manufacture which, while it pretends to no sort of utility, is as mute to the imagination as to the reason. If we must needs have commemorative plate, let it, in the name of common sense, represent, by allegory or otherwise, some tangible idea. Thus the offering of the Prussian nobles to the Crown Prince, exhibited in the western dome, bespeaks its origin and purport, and therefore at once disarms criticism. But the English display is not without examples of better things. Mr. C. F. Hancock exhibits a group of works in silver, designed by Signor Monti, consisting of a vase, two loving cups, and two tazzas, illustrative of the poetry of Great Britain. The vase is surmounted by the figure of Shakspeare, and decorated with medallion heads and bas-reliefs of the principal characters and scenes in the plays of the great dramatist; and the cups, dedicated respectively to the genius of Milton and Byron, are in like manner decorated with subjects selected from the works of those poets; while the tazzas carry respectively ornaments suggestive of the nationalities of the poets Burns and Moore, and illustrations borrowed from their most popular poems. Again, Messrs. Elkington and Co. show a fine work in oxidized repoussé silver, designed and executed for them by M. Morel Ladeuil. This work is a table, at the tripod base of which slumber three figures, symbolising Agriculture, Music, and War; and on the table top are three separate tableaux, representing the Dream of the Sleepers, the design being to pourtray the poetical influence of sleep, by the picturing in dreams of the ideal pursuit after happiness in our waking existence. The table top is surmounted by a central figure of the Goddess of Sleep strawing the slumber-laden poppy over the world. These are, at least, works executed with a definite aim, and in point of artistic merit reflect credit on their designers. For our own part, however, this is a class of art with which we cannot wholly sympathize. Fine art allied to manufacture we hold to be inadmissible, notwithstanding we run counter to the judgment of the great masters of the sixteenth century; and the better the artistic work, the greater is our regret at the, to us, unnatural union. We therefore, while giving due praise to the masterly oxidized silver Titan vase of Antoine Vechte, in Messrs. Hunt and Roskell's collection, cannot but regret this application of a true artist's powers.

Passing now to utilitarian works in silver, we perceive, here and there, traces of a knowledge of the true principles of decoration; but so jostled are these examples by others exhibiting the rampant follies

of a depraved taste (which have, to a great extent, died out in other branches of decorative art) as to be with difficulty discernable. Messrs. Garrard exhibit what are doubtles deemed a superb pair of candelabra, having each for its base a Hindoo temple, from the roof of which rises a branching stem, with sconces to receive wax lights—typical, doubtless, of the elevation of soul and purity of life emanating from the teaching in those holy abodes. If we contrast these with the silver goods in the Indian department, we shall see at once how much our silversmiths have to learn. A pair of single epergnes and a double epergne, in filagree work, from Cuttack, show both beauty of design and exquisite workmanship. Our Indian workmen do not yet perceive the appropriateness of supporting a cut glass dish, destined to receive fruits or flowers, or it may be a trifle or tipsy cake, by a palm tree in frosted silver, which overshadows a group of long-bearded Arabs surrounding a prostate camel. They are content, at present, with some symmetrical structure, equal to the duty it has to perform, and ornamented in a manner that enhances the beauty of the structural form, and suggests the costly character of the material employed. In the same case with the Indian epergnes, are other elegant specimens of filigree work, of which a ring stand and a casket deserve notice. It is, however, but too evident that India is suffering from our bad taste. Interesting as the Eastern collection of goods is, it is very inferior to the display in 1851,—and that mainly from the adoption of European models. Furniture shows the most marked decline, but silver also bears the European blot upon it. Among other imitations, a vase and two goblets, of Grecian form, are ornamented after the Pompeian manner: the flat figures are in burnished silver, and they are brought out by a nebulous ground of frosted silver. The effect is startling to come upon in the Indian department.

When we leave those works which attempt to embody, in some sort, fine art, and come to examples of less pretension, we find many designs that are far from unpleasing. Thus, Messrs. Elkington, although by no means free from the fine art mania, as we have seen, introduce enamelling, with very good effect, into some gilt candelabra, and also a dessert service. The practice is a novelty with our silversmiths, and should be encouraged, for it may, in time, serve to eclipse the "death-struggle" class of manufactures. The quality of the design for enamelled silver, and the manner of working it out, requires, however, most careful attention, even to the minutest details.

It is not our province to lay down canons of taste, further than those which are involved in the construction of designs, and at present we have neither space nor inclination to dwell upon this branch of the subject; but it is our impression, amounting almost to a conviction, that the

mingling of a variety of styles of workmanship in the same design is not admissible. This is a practice freely indulged in, and most noticeably by Messrs. Muirhead and Son, in a dish cover, of Grecian pattern, the lower half of which is ornamented with a band of figures, in bright silver, on a frosted ground. Parallel with, and above this band, is a honeysuckle border, produced by engraved shade lines. The cover is completed by an embossed handle. This combination of three styles of work gives a crude and inharmonious effect, which is not due to any defect in the design itself. A far better effect is obtained by Messrs. Smith and Nicholson, in an electro-plated salver, which has a plain bright centre bordered with a triple band of engraved work, the inner section having the open radial pendent character; the next being a band of conventional ivy leaves, projecting from a continuous serpentine stem; and the outer section a well-knit narrow scroll. The raised edge of the salver is formed of embossed closely knit leaves, in frosted silver, with burnished outlines. This is, perhaps, one of the most satisfactory designs, simple though it be, in the English department. The Wolverhampton Electro-plate Company show good examples of tea and coffee services.

We have as yet said nothing of the revived mediæval silver work. This must now be growing into a considerable manufacture; but it is evident that little invention has yet been imported into it. The reason may perhaps be, that so many elegant and approved designs for church plate exist, that it would be a superfluous labour to create new ones. Mr. John Keith—who appears to have devoted himself specially to the manufacture of church plate, and to have obtained the patronage of the Ecclesiological Society—shows examples of good workmanship which bear the unmistakeable impress of imitation. In his patens he has copied a style which is not in all respects satisfactory. However well repoussé work may suit flagons and chalices, it is quite out of place when applied to the interior of a paten. The centre of a plate or dish, or a salver, must be flat, or its constructive use is destroyed; but Mr. Keith, in conformity with a reprehensible custom, has ornamented many of his patens with embossed figures and devices; whereas engraving or enamelling are here the only admissible styles of ornamentation. Messrs. Hardman and Co., Messrs. Hart and Son, and the Skidmore Art Manufacturing Company also exhibit specimens of revived mediæval church plate, the former firm being thoroughly catholic in their choice of subjects. Of this revival, it may be stated generally, that there is very little life in it; neither can there be until manufacturers resolutely set themselves to work to adapt the style to articles of domestic use. The most happy example of a revival is a parcel-gilt claret jug, of fifteenth century work, by Messrs. Hardman.

They exhibit, also, good specimens of candlesticks; but, in an attempt to adapt the mediæval style to a tea and coffee service, they are quite astray,—the profile being very unsatisfactory; and moreover the spout of the coffee pot is connected with the body by a flying buttress, which is altogether inadmissible. Some spoons and sugar tongs, exhibited by the Skidmore Company, also evidence poverty of design.

In the French department, the mediæval style has its representatives chiefly in M. Orfevrerie and M. Trioullier, whose work is for the most part heavy ecclesiastical, and somewhat overlaid with enamelling and jewels; but it is intended for eyes accustomed to more brilliancy in church decorations than suits Protestant notions of propriety. The designs for communion plate are neither better nor worse than those on the English side, but their monstrances, croziers, &c., have a look of cast metal; there being an excess of metal, irreconcilable with the notions of wrought work. Passing over the monster composite work prepared by M. Christofle, for the Emperor Napoleon, of a triumphal car gliding over a silver lake, which shows at least great artistic skill, and regarding only the utilitarian works, we notice a tea service, by M. Odiot, which possesses a quality by no means common in silver goods, viz., that of showing the value of the metal. The ornamentation, which is of chaste design, consists chiefly of conventional flat foliage, slightly in relief, on sunk panels, and frosted, with bright intermediate ground, and bands interlaced and angular, of bright metal. M. Debain introduces a groundwork of matted silver, which is a good idea, but not made the most of. Messrs. Christofle and Co. are far more successful in the application of this ground to an electro-plated tea service. In their extensive contribution, we also notice a dinner service deserving commendation, the ornamentation consisting of frosted flat ornament on a bright ground. All the pieces of this service, and also other specimens in the same case, are remarkable for grace of form.

Prussia is largely represented by Messrs. Sy and Wagner, and Messrs. D. Vollgold and Sohn, the latter firm showing the costly Berlin gift presented to the Prince and Princess Royal on the occasion of their marriage; and the former showing the Rhine shield already referred to, together with a miscellaneous collection of plate, chiefly of a florid character. In this Prussian display there is evidence of good careful workmanship; but in point of design, especially in the more pretentious pieces, there is the same want of appreciation of the true province of the silversmith that is to be found in the greater number of English examples. Messrs. Sy and Wagner's case also contains some mediæval goblets, in which the subordination of ornament to structural form contrasts most favourably with the ornamental excrescences of the other specimens.

In goods of this class, contributed by other countries, we find nothing to call for special notice: indeed, the few examples we have met with are, both in respect of form and ornamentation, far behind those above referred to.

Before closing our notice of silver and plated goods, it may be well to glance at the cause of the degradation of this important branch of industry. The cause, if we read it aright, is somewhat peculiar, and, we fear, not readily admitting of removal. In the first place, all declension in decorative art is traceable to the same source, viz., the confusion of fine art with decorative art; but the recently acquired knowledge of decorative proprieties has already sufficed to raise some branches of manufactures—as paper hangings and carpets—from their debased condition, and to initiate an improvement in many more. In these instances it was the desire of purchasers to obtain a better class of goods that created the supply. There must, therefore, exist interested as well as intelligent purchasers to induce an improved manufacture. But, are the purchasers of the highest class of silver goods intelligent; and, if so, are they interested in their purchases? Intelligent they may be; but, certainly, they are not personally interested in the success of their selections. Setting aside the fact that a large number of these costly manufactures are disposed of for racing prizes, there is still a larger proportion whose destiny is to become the property of those who have no choice but gratefully to accept them. Thus, to assume a very improbable case, suppose the writer were so fortunate as to confer, through a happy inspiration, some benefit on the squirarchy of England, that entailed upon them the necessity to relieve their consciences by making him a public acknowledgment,—a subscription would quickly be forthcoming, say, for a piece of plate; and one gentleman, being more active than the rest, would probably undertake the selection of a suitable "testimonial," on his next visit to town. In due time some noted shop would be visited, where, for awhile, the squire's choice would oscillate, say, between a spirited boar hunt, in frosted silver, and a vigorous illustration, in burnished silver, of mailed knights jousting; but, soon attracted by a charming home scene—such as may be found in the nave of the Exhibition—which we will call "Securing the Brush," his mind would be instantly made up, because this would be the very thing of all others he would like to expose before his assembled guests, as a neighbourly recognition of his own merits. The writer, therefore, besides being indirectly the cause of encouraging a vile style of art, would be saddled with the care of a treasure which, owing to his too fastidious taste, he would gladly see disappear, like Aaron's golden calf, down the throats of his friends. The fact is, that those who are to become the possessors of the centre-pieces which

our large silversmiths turn out in such abundance, have no voice in the choice of subject, and the subscribers are content if their natural desire to obtain for their money as gorgeous a present as it will buy is attained. The patrons of modern silversmiths at their highest flights require something that will attract at first sight, and are consequently regardless about the point of its being "a joy for ever." With such views, it is easy to admire the palm-leaf candelabrum, presented to Lord Elphinstone, and exhibited by Messrs. Hunt and Roskell, as of the design of Chantrey; but no man of taste could eat his dinner opposite such a thing for many consecutive days, without wishing to consign it to the fate of the pastrycook's elephant, which had so frequently crossed the path of an equally diligent biped attendant at supper tables, as to raise his wrath and destructive propensities. Other testimonials, to be seen at the Exhibition, also bear evidence that a momentary attraction determined their destiny. This could not be the case were the purchaser to be the owner. So large an outlay would ensure consideration, and consideration would not always end in confirmed approval. A ready sale being once established for costly meretricious works, the fact reacts upon the whole trade, and thus, though beautiful works may be purchased in pottery, and even cast-iron, we may look in vain among the silversmiths' stores for works of equal artistic merit. Our only hope is with the mediæval metal-workers, who have a different class of buyers; but hitherto, as we have said, they have not been happy in their adaptations.

Recent Patents.

To EDWARD CHAMBERS NICHOLSON, *of the Atlas Works, Lock's Fields, for improvements in the preparation of colors suitable for dyeing and printing.*—[Dated 20th January, 1862.]

THE inventor takes red dye, such as is made from aniline or its homologue, and heats it carefully in a suitable apparatus to a temperature between 390° and 420° Fahr. The substance quickly assumes the appearance of a dark semi-solid mass, the red dye being transformed into a dark substance with evolution of ammonia. The mass he prefers to extract with acetic acid, using a quantity of acid about equal in weight to the amount of red dye treated, and diluting it with enough alcohol to make a dye of convenient commercial strength. The solution obtained is of a deep violet or purple color, and may be used directly for dyeing purposes.

The patentee claims, "the producing a violet or purple color from red dye, such as is made from aniline or its homologues, by carefully heating it as described, without admixture either of aniline or its homologue."

To Timothy Morris *and* Robert Weare, *both of Birmingham, and* Edward Henry Cradock Monckton, *of Fineshade, Northamptonshire, for improvements in submarine and other telegraphic communication, and in apparatus connected therewith.*—[Dated 21st December, 1861.]

In conveying telegraphic communications, according to this invention, the electric current employed is obtained by the medium of an induction coil of the following novel construction:—Upon an iron core, or a bundle of iron wires, two or more layers of thick insulated copper wire or insulated copper ribbon are to be coiled; one end of this wire or ribbon is attached to one side of an automaton break of a novel construction, and the other side of this break is attached to the other side of the battery. The improvements in this break are of such a nature, as to render it self-cleaning, whereby a more uniform action is obtained. Instead of causing a spring to come in contact with a pin, as is generally done, the break spring is made in two parts or divided, so that the break pin passes between the slit of the spring or between the two springs, by which means the friction keeps the surfaces clean, thereby making better contact between the battery and primary wire or ribbon. To this break is attached what is termed a "condenser," which is constructed as follows:—Sheets of gutta-percha, india-rubber, varnished paper, or other insulating materials, are cut to the desired size; upon each sheet is laid a sheet of metallic foil, such as lead, tin, zinc, or a metallic alloy, cut a little smaller than the sheets of insulating material, and placed alternately to extend over the insulator at one end, for the purpose of being connected together in such a manner, that if the condenser consisted of fifty plates or sheets, twenty-five of them would be connected together at each end, these ends being joined to the break, as before stated. Upon the thick wire or ribbon, and carefully insulated therefrom, is coiled a finer insulated copper wire, and between each layer is inserted a sheet of gutta-percha, india-rubber, or varnished paper, and as the number of layers of wire are increased, so is the thickness of the insulating material increased. The first end of this thin wire may be connected with a line wire of a telegraph, or to the earth connection; the last end of the coil to one side of an instrument termed an "interrupter," and the other side of the interrupter is to be joined to the telegraph.

The interrupter is constructed in the following manner:—Upon an insulated stand are erected two metal pillars, having connecting screws to attach the wire from the coil, and the wire from the telegraph. Upon these pillars is arranged an adjusting screw, by means of which the conducting wire is divided, and may be adjusted to any amount of separation, according to the length of the communicating wire.

In Plate V., fig. 1 represents the induction coil, condenser, and break; and fig. 2 the interrupter. *a*, is the coil; *b*, the terminal from the first or inside end of the fine or secondary wire; and *c*, the last end of the secondary wire. The terminal *b*, is joined to the earth connection, the terminal *c*, with the interrupter *d*; the other screw of the interrupter is connected to the telegraph instrument *h*, by means of the wire *e*; the other connection of the instrument *h*, is with the line wire or cable *f*, joined to the instrument *i*, and to the earth connection by the wire *g*. It will be observed, that the insulating layers between each coil of the secondary wire increase constantly in thickness; only a few layers

are shown, but they may number from fifty to two or three hundred, or more, according to the number of layers of wire in the coil. *k*, is the condenser, in which plates or sheets of tin or other metal *l*, are placed, and insulating material *m*, is inserted between each. The ends of these plates or sheets are turned up, as shown, and communicate alternately with each other and with the coil. *s*, is the break spring attached to the spring of the hammer or armature; the break spring has a slot or division at its upper part, through which the pin or screw *p*, penetrates, and whereby contact is established, and *vice versâ*. The connections between the commutator *t*, and break, are as ordinarily arranged. Any number of plates or sheets may be arranged in the condenser: about seventy or eighty will be found, in most instances, to afford immense power. The interrupter, as just described, may be obviously varied in detail, the object being the same, viz., to effect one, or, if necessary, more breaks or interruptions to the induced current; or the wire itself may be simply severed and maintained at the requisite distance of separation to afford the maximum effect; the electric spark flowing from one wire to the other, across the space of interruption. By this invention, a greater and steadier amount of deflection of the needle is obtained in the galvanometer than by the ordinary metallic circuit, and the needle is thus deflected steadily either to the right or left. The condenser may be made of other materials and in other forms than that described, the principle being the same, the object of which is to form a reservoir for the electricity to spread over, which remains in the primary wire when contact is broken; in short, the method is a substitute for a Leyden jar or jars, which may, under certain circumstances, themselves be used in lieu of the condenser described, where space is not an object.

The patentees claim, "the improvements in submarine and other telegraphic communication, and in apparatus connected therewith, substantially in the manner herein described and set forth."

To HENRY COOK, *of Manchester, for an improved mode of, and apparatus for, transmitting despatches and small articles, by the agency of electricity,—being a communication.*—[Dated 8th January, 1862.]

THIS invention relates to a novel method of transmitting written or printed despatches, letters, or other small articles, by electricity. The telegram, despatch, or information to be transmitted, is written or printed on paper, placed in a carriage, which runs along a line of railway, laid in a tube or pipe formed of a series of hollow electric coils or electro-magnets. The carriage is propelled by the agency of magnetic electricity, which is induced in the hollow coils by a travelling battery mounted on the carriage. It is well known that a bobbin, surrounded with coils of insulated iron or copper wire, has the power, when the above-mentioned wire has a current of electricity passed through it, of attracting into its interior a bar of iron of the length of the bobbin. Upon this principle the electric propeller for transporting despatches, letters, and other small articles, is constructed.

In Plate V., fig. 1 is a perspective elevation of part of a line of railway, constructed to carry out the objects of the present invention. It will be seen that, in this instance, the tube is not continuous, but is

constructed in lengths; such parts only of the tube being employed as are surrounded by the electric coils. A, is an electric coil, which is composed of insulated iron wire, wound round a rectangular metallic frame, leaving a hollow space inside, measuring about fifteen inches long, by six inches square in sectional area. At the commencement of the line, these coils may be arranged at gradually increasing distances apart, commencing at about three feet from each other. B, B, are the line of rails on which the carriage to be propelled runs. Fig. 2 is an end view, showing the carriage *c*, on the rails *b*, *b*, which are laid along the inside of the coil A. The carriage C, consists of a rectangular box, provided with running wheels *c*, *c*, figs. 1 and 2, or sledge irons, whereby it may be supported on the rails, and may be moved thereon with very little friction. Inside the carriage C, is placed a Smee's or Bunsen battery, consisting of any desired number of elements according to the power desired; and wires from the two poles of the battery are connected to the insulated metal plates or blocks *d*, *d*, on the top of the carriage. The spring connections a^1 a^1, of the coil A, project therefrom, and when the carriage C, enters the interior of the coil, these spring connections come in contact with the surface of the blocks *d*, *d*, and thereby complete the electric circuit, and convert the coil A, into an electro-magnet, which will attract and draw forward the metal carriage C, and will communicate such an impulse to the carriage as will drive it forward to the next coil. In order that the action of the second coil shall not be interfered with by the action of the first, after the impulse has been given, the electric circuit of the first coil is interrupted by the metal blocks *d*, *d*, passing from under the spring connections a^1, a^1. To increase the power of the apparatus, the carriage C, should be filled as far as practicable with iron wires, leaving only space enough for the battery, and for the written or printed messages or letters. It is preferable, however, that the despatches or other articles should be placed in a separate carriage, which may be attached or connected in any convenient manner to the first carriage, which may be considered as the locomotive or traction engine of the train which runs through the coils. It will, of course, be understood, that not only one, but two, three, or more carriages, to convey despatches or letters, may be connected together in the form of a train, if desired; the weight to be drawn, being dependent upon the power or tractive force of the electro-magnet.

The patentee claims, "the application of the tractive power of electric coils, to cause an armature of iron, constructed in the form of a hollow vessel, casing, or carriage (made to contain articles of various kinds), to pass along a continuous line of rails placed within, and extending throughout, a series of tubular electrical coils, as herein set forth."

To WILLAM HENRY PREECE, *of Southampton, for improved apparatus for signalling upon railways.*—[Dated 10th January, 1862.]

THE object of this invention is so to simplify the system of telegraphing signals to pointsmen and others engaged upon or in the working of railways, that the risk of mistakes in the reading of the signals may be wholly avoided. To this end it is proposed, in place of relying upon the deflections of needles or other arbitrary signals, dissimilar from those

used for the regulation of trains, upon the line of railway to which the invention is to be applied, to assimilate the signals of telegraphic instruments to the visible line signals used upon and familiar to all persons in the working of the railway. This is effected by adapting to telegraphic instruments a semaphore arm or disc, or other indicator, as the case may be, which is operated by electro-magnetic power.

In Plate V., fig. 1 shows, in side elevation, the instrument for telegraphing to pointsmen signals which are a counterpart of those used upon the line for indicating whether it is blocked or open. A, A, is a wooden stand, on which the signalling instrument is fixed; B, is a pair of metal standards, screwed down to a metal bed plate C, and coupled together at top by a cross bar. These standards B, serve to carry the fulcrum pin of a compound rock lever D, D¹, to which is attached an armature E, of soft iron. This armature E, stands over the poles of the electro-magnet F, through the coils of which a current of electricity is transmitted when it is desired to set the magnet in action and cause it to attract the armature E. The rear end D¹, of the rock lever is connected to a vertical rod G, which slides in guides in a hollow standard H, and is furnished at its upper end with rack teeth H¹. These teeth gear into a pinion I, attached to the axle of the semaphore arm K, which axle has its bearings in the hollow standard H. The end D, of the rock lever carries a pair of flat springs 1, 1, which have a tendency to stand out from the lever, and serve to ease the action of the instrument as the rock lever plays between two adjustable stops 2, 3, the former of which is carried by a metallic standard L, secured to the wooden stand, and the latter by a metallic pillar M, also attached to the wooden stand. Both of these supports are therefore insulated. The rock lever is furnished with a bracket arm N, for carrying an adjustable weight O, the object of which is to regulate the poise of the semaphore arm and its connections. The instrument, when not in action, will stand in the position shown—that is, the weight of the semaphore arm, together with the rod G, which is connected therewith, through the gearing, by depressing the end D¹, of the rock lever that carries the armature, will hold that armature suspended above the magnet. When, however, a current of electricity is thrown into the coils of the magnet, the armature will be attracted by the magnet and held in contact therewith so long as the current is maintained. This downward movement of the armature will raise the end D¹, of the rock lever, and with it the rack rod G, which, through the pinion I, will turn the axle of the semaphore arm in its bearings, and elevate the semaphore to the position shown at fig. 2. As soon, however, as the current is broken, the attraction of the magnet will cease, and the armature E, being free, the semaphore arm will fall, and all the parts will return to the position shown at fig. 1.

The manner of adapting the invention to the requirements of railways will be best explained by reference to the diagram fig. 3, which represents two similar instruments, with their batteries set at two distant points A, and B,—say at opposite ends of a long tunnel—and connected with two bell or audible signal instruments, fitted with a visible signal, which signal indicates the state of the semaphore at the distant station. Let it now be supposed that it is the duty of the pointsman at the station A, to operate the instrument at the station B, and that the pointsman at B, has the operation of the instrument at A, under his command, and that the

audible signals are operated in the usual manner, and employed to attract the attention of the pointsman, and signify the approach of a train, the normal state of the semaphore instruments being as shown at fig. 1,—that is, indicating that the line is open. If, now, the line is clear, and a train is about to start from the station A, towards the station B, the pointsman at A, by means of the finger key P, will sound the bell at the station B, signifying that the train has started. The pointsman at B, will then, by means of a switch key Q, return A's, signal, and raise the semaphore of the instrument at A. By this action, metallic contact will be set up between the rock lever D, and the pillar M, of the semaphore instrument at station A, and a current of electricity will pass thence to the bell signal at station B, giving an audible signal, intimating that the semaphore at A, is raised, and indicate the same on the dial of the bell instrument. The construction of this audible and visible signal instrument being well known, it will be unnecessary here to explain it. The semaphore at A, will continue elevated, thereby indicating danger, until the passing train has arrived at B; the pointsman at B, will then restore the key Q, to its former position, and thereby lower the semaphore of the instrument at station A, and return the index on the bell instrument, at station B, to its former position. When a train is passing along the line in the opposite direction, the reverse of the above-described movements will take place—that is to say, the first signal will be given by the pointsman at station B, who will, by the depression of the key P^1, set the audible signal apparatus at station A, in action, and the pointsman at A, will, by means of the key Q^1, set the semaphore of the instrument B.

The arrangement of the electrical connection for effecting these operations will be seen by referring first to the semaphore instrument A, an under side view of which is shown at fig. 3. It will be seen that the metallic bed plate C, is connected by a wire 4, with a terminal 5; the electro-magnet is connected by wires 6, to the terminals 7, and 8, the former of which is connected with the earth, and the latter, by means of the line wire 9, with the switch key Q, at the station B. The standard L, which carries the point 2, has metallic connection through the wire 10, with the terminal 11; and the pillar M, which carries the point 3, is similarly coupled, by a wire 12, with the terminal 13. R, is a battery at station A, connected by a wire 14, with the terminal 13, and this terminal is further connected by a wire 15, with the key P. A second wire 13*, from the key P, passes to the terminal 5, and a third wire, from the key, passes to the line wire 16, which wire is connected with the corresponding key P^1, at the station B. From the terminal 11, a wire 17, passes to the audible signal apparatus of the station A, which apparatus is, by means of a wire 18, connected with the earth., The battery S, at station A, is connected by a wire 19, with the switch key Q^1, of that station, and the line wire 20, connects this key with the semaphore instrument at station B. The electric connections at the station B, are a counterpart of those already described.

It will now be understood that the pointsman at A, when signalling to B, that a train has started, by the depression of the finger key P, causes a current of electricity to flow from the battery R, through the wires 14, and 15, to the key P, thence by the line wire 16, to the key P^1, at station B; then to the plate C, of the semaphore instrument at the station; thence, by the wire 4, leading from the terminal 5, up the standards B, and along the rock lever D, to the point 2, carried by the standard L; and from this

standard, by the wires 10, and 17, to the bell instrument at station B, when the current will find its way to earth by the wire 18. The pointsman at B, having received this signal, will work the switch key Q, thereby connecting the line wire 9, with the battery S^1. A current of electricity will consequently flow from the battery S^1, by the wires 9, and 6, to the electro-magnet of the semaphore instrument at A. While this current is maintained, the electro-magnet will hold down the rock lever D, and bring it through its lower spring 1, into contact with the point 3, of the pillar M, thereby raising the semaphore signal of the instrument at A. But, besides this, the movement of the instrument completes the circuit for the current from the battery R, and allows it to pass—instead of through the wire 15, as already explained—to the audible signal at the station B, by the wire 12, to the pillar M, thence through the rock lever D, and standard B, to the bed plate C, and by the wires 4, and 13*, to the key P, which is connected by the line wire 16, as before described, with the bell instrument; and an audible signal, signifying that the semaphore at station A, is set for "danger," is given. As the course of the currents for giving the signals requisite for indicating the passing of a train in the opposite direction is the inverse of that described, and may readily be followed by means of the diagram, fig. 3, it will be unnecessary further to refer to these counterpart operations.

The patentee claims, "assimilating the signals of electrical railway signalling instruments to the line signals of railways, in the manner and for the purpose above described."

To Richard Threlfall, *of Bolton, Lancashire, for improvements in machinery or apparatus for spinning cotton or other fibrous material.*—[Dated 24th July, 1861.]

This invention consists in an improved mode of governing the copping faller of self-acting mules, whilst the yarn is being coiled on the spindles, at the time the carriage has receded to the roller beam; and also in an improved mode of receding the carriage at any desired speed, according to the number of the yarn to be spun.

The figure in Plate VI. represents a transverse view of the carriage, and parts connected with it, of a self-acting mule, having the improvements attached. In order to govern the motion of the copping faller, a friction pulley is attached to the backing-off scroll *a*; a strap or band *b*, being lapped one or more times round it. One end of the band is held by a knot *c*, and the other end connected to a screw *d*, passing through the nut *e*, for the purpose of adjusting the required friction on the pulley. By means of the friction band *b*, the backing-off catch *f*, is held in contact with the ratchet wheel *g*, when the carriage has arrived at the roller beam; and, as the copping faller is unlocked, it is prevented from rising too suddenly, by the catch only allowing it to rise according to the speed of the tin roller, by the action of the friction band on the periphery of the scroll plate.

In order to cause the carriage of the self-acting mule, after the stretch is performed, to recede towards the roller beam at any desired speed, according to the number of the yarn to be spun, a tappet or curved plate *i*, is fixed to the twist shaft *k*, which makes one revolution in a stretch.

This tappet acts against the suspended lever *m*, and moves it in the direction of the arrow, whilst the last portion of the twist is being put into the yarn. The lever *m*, is connected to the rod *n*, jointed to the upright lever *o*, working on the stud *p*, fixed to the framework *q*. The upright lever *o*, carries the ordinary catch lever *r*, working on the stud *s*, there being a bracket *t*, to regulate the position of the catch lever. In the figure, the carriage is represented as going out in the action of spinning, and the stud *u*, has to travel over the curved part *v*, and finally to fall in the slot *w*, which allows time for the second stretch to be performed. When the stud has fallen into the slot, the receding of the carriage takes place, the distance of which is regulated by the tappet or curved plate *l*, which shortens the distance of the length of stretch, and enables the mule to spin counts of yarn never before accomplished, the form of the tappet *l*, being varied as required, to suit the number of yarn to be spun. The unlocking of the catch lever *r*, is performed in the ordinary manner, by the descent of the rod *x*, having upon it the tappet or presser *y*, which acts upon the projection *z*, and depresses the catch lever *r*, so that the stud *u*, is liberated from the slot *w*, and allows the carriage to be put up; the rod *x*, being acted upon by the putting-up rod.

The patentee claims, "the improved mode of causing the faller to rise exactly in proportion to the speed of the tin roller, and also the improved mode of receding the carriage towards the roller beam at any desired speed, according to the number of yarn to be spun."

To James Higgins *and* Thomas Schofield Whitworth, *both of Salford, for improvements in machinery or apparatus for spinning and doubling cotton and other fibrous materials.*—[Dated 7th January, 1862.]

This invention consists, firstly, in a method of obtaining the drag, and consists in causing the spindle to be pressed by a metallic surface. According to another part of the invention, the spindle is supported by a tube projecting into the bobbin, and the bobbin by a cap, which is carried by the spindle. Another part of the invention consists in so mounting the flyer, that it may be moved sideways from the spindle, so as to facilitate the removal of the cop or bobbin. Another part of the invention relates to a method of obtaining an end for the commencement of another cop or bobbin, and consists in a provision for raising the spindle, so as to bring a bare part up to the level of the guide or other apparatus through which the yarn or thread passes.

The first of these improvements is shown at figs. 1 and 2, Plate V., which are a sectional elevation and plan of the improved spindle. *a*, is the spindle, turning in the footstep *b*; this footstep is furnished with a recess, within which is placed a loose piece of metal *c*, bearing against the spindle, and provided with a groove *d*. In this groove is one arm of a bell crank lever *e*, turning upon a centre at *f*; the other arm thereof being drawn downward by a spring *g*, so that the piece of metal *c*, is caused to press upon the spindle, according to the elastic force of the said spring, which force may be regulated by turning the nut *h*, in the one direction or the other; and thus any required amount of drag may be obtained. The piece of metal *c*, is cut away at its edges, so as to form the chamber *i*, for the reception of lubricating material, as shown at fig. 2.

The next part of the invention is also shown at fig. 1. The spindle *a*, is supported at its lower end in the rail *z*, and at its upper end by a tube *k*, carried by the rail; above this tube and attached to the spindle is a cap *l*, which at its lower end is provided with a shoulder *m*, upon which the bobbin *n*, rests. In the arrangement shown in connection with this and the first part of the invention, there is a revolving wharve drawn against rollers *p*, by the band which drives it, and carrying pressers *g*, which convey the material to the bobbin. The parts *g**, represent guides which may be used instead of the pressers *g*.

The next part of the invention is shown at figs. 3 and 4. The spindle is at *r*, turning in a footstep *s*, and in a friction bearing *c*, similar to that described under the first part of the invention. The flyer is at *t*, mounted in a top bearing *u*, and provided with a wharve drawn against rollers at *p*, by which it is supported. The material is conveyed to the spindle by pressers *g*, as previously mentioned. The top bearing *u*, is carried by a quadrant *v*, which is mounted in guides *w*, and provided with a rack *x*, in gear with which is a pinion *y*; by turning this pinion, therefore, the quadrant is caused to move in its guides, and turn the flyer over into the position shown at fig. 4, and thus allow the cop to be withdrawn from the spindle.

The next part of the invention will be understood by referring to fig. 3. Beneath the rail *z*, which supports the tube and spindle, is adapted a shaft provided with excentrics, not shown in the figure, which, by being turned, will elevate the spindle, so as to bring a portion thereof just below the completed cop as at A, opposite to the guide *g*, which conveys the material, and the spindle being then turned a few revolutions, will provide an end for the commencement of a fresh cop.

The patentees claim, "Firstly,—the use of a drag, produced by the pressure of a metallic surface against the spindle, and the application thereto of the chamber for lubricating material. Secondly,—the method of supporting the spindle and bobbin described in reference to fig. 1. Thirdly,—so mounting the flyer, that it may be turned from the central line. Fourthly,—raising the spindles, so as to bring portions thereof below the completed cops, opposite to the guides which deliver the material."

To RICHARD ARCHIBALD BROOMAN, *of Fleet-street, for improvements in shears or scissors, chiefly applicable to be employed in the manufacture of lace,—being a communication.*—[Dated 1st January, 1862.]

THIS invention is intended chiefly to be applied for severing the large threads surrounding net tulle and machine-made lace, for which purpose ordinary scissors have been hitherto used. The invention consists in the arrangement of several pairs of cutting blades in one and the same instrument. Two plates, the lengths of which are regulated according to the number of cutting blades employed, are connected to handles; the cutting blades of the scissors are secured to the plates by screws, inserted in slots formed in them; a guard plate covers the heads of the screws, which secure the upper cutting blade, to prevent the threads catching in them. The ends of the upper blades are bevilled, which, in combination with guides formed of thin metal connecting two adjacent

cutting blades, guide the threads to be cut between the two blades. Springs between the handles, keep the blades apart until pressure is applied to them.

In Plate VI., fig. 1 is a plan, and fig. 2 a side elevation, of the shears. *a*, a^1, are the two metal plates united to the handles *b*, b^1; *c*, *c*, are slots formed in each of the plates *a*, a^1, to receive and regulate the position of the lower cutting blades *e*, as well as the upper blades *d*, by means of the screw *f*. The two plates are united by the screws *j*, upon which the blades *d*, *e*, are pivoted; *h*, is a guard, formed of a bent and pliable metal plate, fixed beneath the lower plate a^1, to facilitate the sliding motion of the instrument, thereby preventing the tulle or lace from getting entangled in the heads of the screws which hold the lower blades. The bevilled form of the ends of the blade *d*, enables the large threads which are to be cut, to get placed between the blades. *i*, i^1, are other metal guides for further aiding the passage of the threads; *k*, k^1, are springs between the handles *b*, b^1, to keep the scissors open. To cut several threads at a time, the workman, on taking hold of the handles, compresses the spring *k*, k^1, and brings the cutting blades together all at one and the same time, cutting several threads at once.

The patentee claims, "the construction of shears or scissors, with two or more pairs of cutting blades, substantially in manner, and for the purposes hereinbefore described and illustrated."

To Samuel Sheppard, *of Birmingham, for a new or improved tap or stop-cock.*—[Dated 18th December, 1861.]

In Plate VI., figs. 1 and 2 represent, in vertical longitudinal section, the improved tap or stop-cock forming the subject of the present invention. Fig. 1 shows the moving parts in the position they occupy when the tap is opened, and fig. 2 the moving parts in the position they occupy when the tap is closed. *a*, is the body or barrel of the tap, into the bottom of which the inlet pipe *b*, opens; *c*, is the outlet pipe; *d*, is the valve seat, situated at the bottom of the body or barrel *a*, and between the inlet pipe *b*, and outlet pipe *c*; *e*, is a valve connected with the plug *f*, situated in the barrel *a*, and made to fit the barrel. The valve *e*, may either be fixed rigidly to the bottom of the plug *f*, or connected loosely therewith. At the lower end of the plug *f*, is a washer *g*, which effectually secures the tight fitting of the plug *f*, in the barrel *a*, and thereby prevents the escape of liquid or gas at the barrel *a*, when the tap is opened. The plug *f*, is provided with a handle *h*, for giving a partial motion thereto. This motion raises or lowers the plug *f*, in the barrel *a*, in the following manner:—In the plug *f*, is an inclined slot *i*, passing about one-half round it, and receiving a screw-pin *k*, which is passed through the side of the barrel. On rotatory motion, therefore, being given to the plug *f*, it will move in the direction of its axis. When the handle *h*, is in the position represented in fig. 1, the valve *e*, is raised from the valve seat *d*, and there is a free passage through the tap; and, when turned into the position represented in fig. 2, the valve *e*, is pressed upon the seat *d*, and the tap is closed.

The patentee claims, "the new or improved tap or stop-cock herein

before described and illustrated—that is to say, a tap or stop-cock in which a valve is raised from and pressed upon its seat by means of the arrangements of parts described and represented."

To JOSEPH WESTWOOD, *of Poplar, for an improvement in the construction of hydraulic presses.*—[Dated 20th September, 1861.]

THIS invention consists in constructing hydraulic presses in such a manner that the cylinder and ram are capable of being moved to one side or other of the press by means of traversing gear fitted to such cylinder.

In Plate VI., fig. 1 is an elevation, and fig. 2 a plan or horizontal view, of the press, with the traversing gear applied thereto. A, is the top crosshead, supported by four columns B, B, which are secured in the bottom crosshead C. The upper ends of the columns have screw threads formed on them for a considerable length, in order to admit of variation and adjustment in the height of the crosshead A, above the press. D, is the cylinder containing the ram: it consists of an inner cylinder, strengthened by external rings, and has a loose or moveable bottom, and can be moved along the face of the bottom crosshead by means of traversing gear. This gear consists of a ring E, into which the bottom of the cylinder D, is fixed, such ring having flat sides, which work in the V guides F, F. On the upper side of the ring are formed two bosses or nuts G, G, through which the screws H, H, pass, the same being worked by the wheels I, I, from the pinion K, set in motion by the winch handle L. It will thus be evident, that by turning the winch handle L, and setting the pinion K, in motion, in either direction, the wheels I, I, will be turned simultaneously; thereby turning the screws H, H, and moving the cylinder D, along the bottom crosshead C, in the direction required. The mode of moving the cylinder may, however, be varied.

The patentee claims, "the construction of hydraulic presses, in such a manner, that the cylinder and ram are capable of being moved to one side or other of the press, by means of suitable gearing connected to the cylinder."

To WILLIAM MATTIEU WILLIAMS, *of Handsworth, Staffordshire, for an improvement or improvements in treating coal and other bituminous minerals and peat, in order to obtain solid and liquid hydro-carbons therefrom, and in apparatus to be used for that purpose.*—[Dated 21st December, 1861.]

THE object of this invention is so to treat coal and other bituminous minerals, and peat, by the distillatory process, as to increase the solid and liquid or more valuable products, in proportion to the gaseous or less valuable products. In the distillation of coal, it is found that the gaseous products of the distillation are mainly or largely produced by the decomposition of the vapours of the solid and liquid products; the decomposition being effected by such vapours coming in contact with portions of the retort or its contents, heated to a higher temperature than that at which the vapours are liberated from the coal. By conducting the distillation

in the manner and by means of the apparatus hereafter described, the overheating of the condensible products, first volatilized from the coal, is prevented, and thereby a larger yield of the condensible products is secured.

The apparatus used for treating coal and other bituminous minerals, and peat, in order to obtain solid and liquid hydro-carbons therefrom, is shown in Plate V.; fig. 1 being a vertical longitudinal section of the retort, set in a reverberatory furnace, and fig. 2 a cross vertical section. The flame and products of combustion from the fire in the fireplace *a*, pass along the reverberatory arch *b*, into the chimney or flue *c*. The heat is reverberated downwards upon the bed *d*, of the furnace, which bed *d*, constitutes the top of the retort *e*, or a casing immediately above the top of the retort. The lower part of the retort *e*, tapers or contracts, as seen in fig. 2. Where the vessel is short, it is made taper on all sides—that is, it is made of the figure of an inverted cone or pyramid, but when much longer than it is broad, the tapering is confined to the inclination of the two longer sides, as represented in figs. 1 and 2.

The coal or other matter to be treated is placed in the cage or tray *f*, which rests upon the projections *g*. The sides of the tray *f*, are perforated, or are made of bars. The trays may be introduced into, and withdrawn out of, the distillatory vessel *e*, in a horizontal direction, at an opening in the side of the vessel at *h*, which opening is closed after the introduction of the charge, by means of a door *i*. The plate *d*, which constitutes the bed of the furnace and the top of the distillatory vessel, may be protected from injury by the fire, by a layer of thin fire-tiles or powdered clay or sand, or a mixture of clay and sand. The fire of the furnace *a*, plays upon and heats the top of the vessel *e*, and the heat from the heated top radiates downwards upon the contents of the tray *f*, and liberates volatile hydro-carbons therefrom. The vapours produced pass out between the bars constituting the sides of the tray *f*, or through perforations in its sides and bottom, and descend to the lower part of the distillatory vessel, from which the condensed and uncondensed portions pass by a pipe *k*, fixed nearly at the bottom of the vessel *e*. A small quantity of water, which is formed or volatilized with the hydro-carbons, condenses and occupies the bottom of the vessel *e*, and may be let off by a stop-cock fixed at the lowest point of the vessel *e*.

In carrying this invention into effect on a large scale, several retorts or distillatory vessels are employed, arranged side by side in the same furnace. In this case, the retorts are placed across the reverberatory arch of the furnace, as represented in the vertical section, fig. 3, which is taken along the middle of the reverberatory arch *l*. Each of the retorts or distillatory vessels consists of a chamber *m*, the sides and bottom of which may be made of iron or of brickwork. The top of the chambers consists of a plate, or series of plates, of cast or wrought iron *n*, on which the heat of the furnace is reverberated by the reverberatory arch or flue *l*. In the middle of each retort or distillatory vessel is a wall or support of brickwork *o*, running from end to end of the vessel. The said walls or supports *o*, in each vessel, support the trays *p*, containing the material to be operated upon. The trays are introduced into the retorts *m*, at openings at the end of the vessels, similar to the openings hereinbefore described and represented in fig. 1, or those employed in ordinary gas retorts. Pipes at *q*, conduct the condensed and uncondensed products of distillation

away from the distillatory vessels into a receptacle, where the condensation of the condensible products may be completed.

The distillation may either be conducted at atmospheric pressure, or at a greater or less pressure than that of the atmosphere. In the first case, the terminal pipe of the retort is open, and the condensed products run therefrom. In the second case, the bottom of the pipe is closed by a valve, weighted, so as to give the required pressure. In the last case, the terminal pipe of the retort is connected with an exhausting pump or other exhausting apparatus, worked by steam or other power.

The patentee claims, "First,—the improvement hereinbefore described, in treating coal and other bituminous minerals, and peat, in order to obtain solid and liquid hydro-carbons therefrom—that is to say, subjecting these substances to a distillatory process so conducted that the volatile products produced pass rapidly downwards from the heated part of the apparatus, so as not again to be exposed to a temperature equal to that at which they were produced. Secondly,—the improvement in apparatus for treating coal and other bituminous minerals, and peat, in order to obtain solid and liquid hydro-carbons therefrom, hereinbefore described and illustrated—that is to say, constructing and arranging the retorts or distillatory vessels so that heat is applied at the top of the said vessels, and the volatile products conducted, by a descending motion, from the heated parts of the said apparatus."

To WILLIAM BARKER PATRICK, *of Highgate, for improvements in the manufacture of sugar, and in the apparatus employed therein.*—[Dated 1st January, 1862.]

IN the manufacture of sugar, as generally practised, the evaporation of the solutions or syrups has been obtained by employing usually a temperature of at least 212° Fahr.; but this amount of heat is found prejudicial to color and crystallization, and various methods have, at different times, been devised to counteract these injurious effects, by the introduction of air at a low temperature into the solutions whilst thus being heated in open pans, and by other means; but so long as a high temperature is employed, some portions of the mass, whilst being operated upon, must necessarily come in contact with, and be prejudicially acted upon by, the surfaces of the boiling pan or vessel, with a tendency to neutralize any benefit arising from the introduction of the cool air; and there is but little, if any, better result, when a low temperature is employed, on account of the increased length of time required for the operation.

According to this improvement, a closed vessel or vacuum pan is employed, and the saccharine syrups or solutions are heated therein to a low temperature, considerably below the boiling point, by means of hot water, air, or vapour, caused to circulate in pipes in or around such vessel, or in the jacket or outer case thereof, combined with the use of air heated to about the same temperature, forced through openings in a pipe or pipes, applied so that the air may be distributed amongst, and pass through, the syrup or solution, and thereby aid in driving off the aqueous particles contained therein in the form of vapour, which are then drawn off by the air pump or other suitable means. By these means improved

color and increased amount of crystals will be obtained with less molasses or treacle. The improvements are adapted either for operating upon the juices directly as obtained from the cane or root, or upon the syrup.

The improvements also relate to the application of fine reticulate openwork to the passage from the vacuum pan, to prevent the passage of syrup or crystals, as is often the case by the action of the vacuum pump, and yet admit of the passage of the air, steam, or aqueous particles.

The figure in Plate VI., shows a side view, partly in section, of a closed pan, arranged to carry out the invention for the evaporation of saccharine syrups; *a*, being the outer case thereof, and *b*, a jacket to the lower part of it, adapted to receive hot water, air, or vapour, for the purpose, together with the coils of pipes *c*, of raising the temperature of the saccharine matters as required, and which at the early stages of evaporation, should be about 212° Fahr.; such temperature being materially reduced as the operation proceeds, say, to about 150° Fahr. The heating medium is supplied to the jacket *b*, by pipes b^1, from the main b^2, which is fed in any suitable manner, and such medium, as it becomes cooled, is allowed to flow away, or is drawn off by the pipe b^3, which is supplied by an adjustable valve b^4. The internal coil *c*, may be supplied by passages c^1, from the main b^2, or by a separate pipe, and the medium drawn or allowed to flow therefrom by the passage c^2. *d*, *d*, *d*, are other pipes, supplied by the pipe d^1, and passing through the vessel *a*, into the syrups under operation, for the purpose of conducting heated air thereto; such pipes being formed at their lower ends with valves *e*, the stems of which are acted upon by the screw e^1, so as to regulate the size of the passage by such valves from the pipes *d*, to the interior of the pan, and to admit of such passages being altogether closed, so as to prevent incrustation therein by the accumulation of crystals formed from the saccharine solutions, when from the progress of the operation, it is desirable that air should cease to be allowed to pass through such pipes. The top of the pan may be fitted as shown in dots, with a screen of openwork *f*, applied thereto over the outlet passage for the vapour, to prevent the escape of particles of crystals with such vapour. It is preferred to attach this screen by hooks or other means adapted to admit of its having a slight play.

The patentee claims, "operating upon syrups or solutions in the manufacture of sugar, and the combination of means or apparatus employed therein, in manner substantially as explained."

To WILLIAM KEMPE, *of Holbeck Mills, Leeds, for improvements in scrays or tables, applicable to gig mills, brushing mills, and other like machinery.*—[Dated 21st December, 1861.]

THIS invention has for its object, so to improve the scrays or tables which are attached to gig mills, brushing mills, and other similar machines, that where the cloth or fabric has to pass more than once through the machine, it may be supplied in the exact quantity and position required by such mill or machine, without any undue pull or strain upon the fabric; thereby reducing the amount of attendance required, and rendering the machine to a great extent self-acting. In place of the flat or inclined

table or scray, or the trough scray of the gig mill or brushing mill, the patentee fixes parallel to each other two frames, having the form of an inverted semicircle or curve, but having projecting feet to fix them firmly to the floor. These frames are of cast iron, and fastened together by any suitable and convenient arrangement. Through the top of each limb of the semicircular or curved framing on one side, a shaft is passed at right angles to the framing, and continued through the top of each limb of the semicircular or curved framing on the other side. Thus there are two shafts extending across the machine at the top of each limb of the semicircular or curved framing parallel to each other, but at right angles to the two curved frames which form the sides of the machine. At each end of these two shafts, but within the framing, a chain wheel is fixed to receive two endless chains, parallel to the two semicircular or curved frames. These chains are put on sufficiently slack, that they may rest upon the semicircular or curved sweep of the frame through its entire curve; and to them is fastened a series of laths across the machine, that is to say, at right angles to the chain,—one end of each lath being fastened to a link of one chain, and the other end of the lath being fastened to a corresponding link of the other chain. This part of the machine, therefore, becomes a continuous platform, free to move as the chain pulleys are moved. The cross shafts are coupled together by any convenient arrangements for securing their simultaneous and uniform motion, which motion is derived from a driving shaft. It will be evident, from the two shafts working uniformly and simultaneously, that one part of the endless chains, with the laths affixed, forming the scray, will descend one limb of the semicircular or curved sweep in the same time and quantity as another part of the scray is ascending the other limb, so that the scray will always retain its semicircular or curved form. The cloth or fabric, being delivered from the gig mill or other similar machine, in plaits or folds, at the top of one limb of the semicircle or curve, travels down with the scray, and is carried up the other limb of the semicircle or curve, ready for delivery again to the gig mill or other similar machine. It will thus be seen that the cloth, in travelling round the semicircle or curve, changes its position, —that which was underneath at one limb of the curve being uppermost at the other.

The patentee claims, "the combination of mechanism described, whereby the folds of cloth received on to a moveable scray are caused, by the form and motion of the scray, to be turned over before passing off the scray, and in such manner, that that which was undermost when received on to the scray, is uppermost when about to pass off the scray."

To EUGENE ETIENNE PEREAU, *of Moorgate-street, for an improved composition for cleaning and revivifying woollen cloths and other fabrics, and the colors thereof,—being a communication.*—[Dated 20th December, 1861.]

THIS composition is made either white or colored, its trade name being "*eau écarlate.*" It cleans and removes the stains from, and revivifies the color of, woollen and other fabrics, as well as the fabrics themselves. It is formed of citric acid, carbonate of potash, alum, alcohol, and water, to which coloring matter—say, for instance, cochineal—may be added, to

impart the color required. Other acids or acid salts—such as oxalic acid, tartaric acid, cream of tartar, nitric acid, sulphuric acid, salt of sorrel, or other acid salt, capable of producing the same effect—may be substituted for the citric acid in the composition of the *eau écarlate.*

The following proportions have been found to answer well:—Citric acid, 4 parts, by weight; carbonate of potash, 8 parts; alum, 1 part; alcohol, 1 part; and water, 100 parts.

The patentee claims, "the improved composition hereinbefore described."

To François Laurent *and* John Casthelaz, *of Paris, for improvements in the manufacture of coloring matters.*—[Dated 24th December, 1861.]

In manufacturing coloring matters according to this invention, the patentees take nitro-benzine or nitro-toluine, or other homologue of nitro-benzine, or a mixture of these substances, and, by a process of deoxidization, obtain a red colour, varying somewhat in shade, according to the method in which the deoxidizing process is conducted, and the extent to which it is carried.

In preparing the red coloring matter, which the patentees term "erythro-benzine," take 12 parts of nitro-benzine, by preference that prepared (with nitric acid in the usual manner) from benzine, boiling at a temperature from 85° to 100° cent., and add thereto 24 parts of fine iron filings and 6 parts of concentrated commercial hydrochloric acid. This mixture—being allowed to stand for twenty-four hours, or thereabouts, at the ordinary temperature, without application of artificial heat—gives a solid mass, having a resinous appearance, containing iron, chloride of iron, and erythro-benzine, which having crushed, the patentees obtain by water a clear solution, and precipitate the coloring matter by adding to it chloride of sodium. The color thus obtained, after being again dissolved and precipitated, is ready for use, and it may be employed for dyeing and printing. In place of employing iron filings, in conjunction with hydrochloric acid, some other metals and acids, which, in acting on each other, generate hydrogen gas, may be employed—as, for example, zinc and sulphuric acid—as may also some substances which have a tendency to combine with oxygen; or deoxidizing agents, which are not too energetic in their action, may be employed. If nitro-benzine is exposed to the action of a powerful deoxidizing process, it becomes changed, as is well known, into aniline, so that it is necessary that the deoxidizing process should be properly regulated.

The patentees claim, "producing red coloring matters, as described, by the action of a deoxidizing agent or nitro-benzine and its homologues."

To Hermann Eschwege, *of Mincing-lane, for improvements in treating wood and other vegetable spirit.*—[Dated 2nd January, 1862.]

This invention has for its object the improved purification of wood and other vegetable spirit. To this end, the patentee first largely dilutes the wood spirit or fermented spirit with water, and then subjects this diluted spirit to the action of a series of wood charcoal filters (preferring at all

times that the temperature should not exceed 70° Fahr.), in such a manner that each successive filter shall effect the filtration of a purer and purer spirit,—the same spirit never passing through a filter to which it has already yielded its impurities, but only through filters lower down in the series.

The proportion of water with which the spirit is to be diluted varies in some degree, according to the nature and purity of the spirit; but a dilution with from 75 to 80 per cent. of water—equal to from 55 to 64 per cent. of under-proof spirit—is usually most beneficial; the water and spirit are to be well mixed, and allowed to stand for about 24 hours; should the diluted spirit have any acid or alkaline reaction, it is preferred to render it neutral before setting it aside.

With regard to filtration, the construction, dimensions, and number of the filters may be varied; but the following is the arrangement recommended for a regular daily purification of some 2000 gallons of proof spirit —that is to say, of some 2000 gallons of about 56 per cent.:—A series of fifteen filters, made of a cylindrical form, about 9 feet in height, and 2¼ feet in diameter, are hermetically connected together, so as to form a succession, and provided with the necessary air cocks. In each filter, at a few inches above the bottom, and also at a few inches below the top, is a perforated plate, and it is between these perforated plates that the charcoal is placed, in order to form the filter. The charcoal should be well burnt, and broken into pieces, about the size of peas. Preference is given to charcoal made from light woods—such as alder, willow, pine, birch, &c. Provision should be made for connecting each of the filters of a series with the vat or vessel in which the diluted spirit about to be filtered is contained; and it is preferred that the arrangements of apparatus used should be such that the diluted spirit should flow from the vessel containing it into the bottom and below the false bottom of the filter, which, for the time being, is the first, and least clean, of the series of filters. It is also preferred that provision should be made for the diluted spirit, as it passes out from the upper end of the first or other filter in the series, that it shall flow into the bottom of the next filter in the series, and so on, from filter to filter, till the diluted spirit passes out of the filter which, for the time, is the last of the series. So soon as it is found that the diluted spirit coming away from the filter which, for the time being, is the last filter of the series, is less pure than is desired, the first filter of the series is to be removed, and a fresh or clean filter introduced into the series, after the filter which was previously the last filter in the series. The supply vessel is to be connected with the filter which was previously the second filter in the series, and the process is to go on till the diluted spirit is again found to be coming away from the newly-introduced, and now last, filter in the series, less pure than is desired; when the filter which has been acting as the first of the series is to be disconnected, and another fresh or clean filter is to be introduced into the series, and is to form the last filter of the series, and so on continuously; whereby the diluted spirit will be at all times successively subjected to the action of cleaner and cleaner charcoal, as it passes from filter to filter, from the time it leaves the supply vat or vessel, till it comes away from the filter which, for the time being, is the last of the series.

The patentee claims, "filtering a sufficiently diluted spirit through a sufficient amount of charcoal, in such a manner that the diluted spirit, by

passing through a series of charcoal filters, shall be successively and constantly acted upon by cleaner and cleaner charcoal, which result is accomplished by the introduction or connexion, from time to time, of a fresh filter to serve as the last filter of the series, and the removal or disconnection, from time to time, of the first or foulest filter of the series."

To JOHN WILLIAM SCOTT, *of Worcester, for improvements in tools for the manufacture of leather and other rings, washers, and laces.*—[Dated 1st October, 1861.]

THIS invention consists in the construction of tools for the manufacture of rings and washers, capable of stamping several of such articles at the same time out of the solid, whether the material be leather, cloth, or other fabric. This is effected by affixing to a plunger or punch a series of concentric circular cutters, and placing between every two an annular piston; all the pistons are connected to a cross bolt or bar, and this bar to an external ring; the bar is free to move in a slot cut in and through the tool.

In Plate VI., fig. 1 is a vertical section of this tool. *a*, is the plunger; *b*, *c*, and *d*. are the concentric circular cutters; and *e*, *f*, and *g*, are the pistons; *h*, is the bolt, passing through the pistons, free to move up and down in the slots *i*, *i*, in the concentric rings, and secured by heads to a ring *k*, extending round the plunger; *l*, is a helical spring bearing against the ring *k*, and upper collar *m*.

The operation is as follows:—On the tool being forced down by a screw or other press, the cutting edges *b*, *c*, *d*, cut out a series of concentric rings, which fill the spaces between them; then, on the rising of the tool, the ring, directly or through the helical spring *l*, and upper collar *m*, comes in contact with a fixed abutment, and depresses the annular pistons *e*, *f*, *g*; whereupon the rings stamped out and held between the cutters are driven from the tool, and the same action takes place on every down and up stroke of the tool.

The improved tools for manufacturing laces consist of a cutting blade fixed or bedded spirally in any suitable bed or holder; the spaces between the coils of the spiral determine the width of the lace. A spiral moveable piston is either used with this spiral cutting blade, or the cutting blade is used without any mechanical contrivance for pushing out the lace, and then the lace is withdrawn from the tool by hand.

Fig 2 is a plan of the under side of this tool. A "head" or solid piece at one end of the lace, to take the place of and prevent the necessity of making a knot as usual, is formed by leaving a space in the centre of the tool, as shown at *n*, and this space may be of any desired shape or device, as, for example, that shown in fig. 3. Sometimes the space is left for forming the solid piece at the outer end of the tool, as shown at fig. 4. The length of the lace is determined by the number of coils in the spiral cutting blade. The tool is sometimes formed with spaces to cut heads at each end, so that by dividing the lace in the centre, two laces are formed, each having a head at one end. The tools are shown circular; they may, however, be oval, or of any other convenient form.

The patentee claims, "First,—the construction of tools for cutting leather and other rings and washers with a series of fixed concentric

cutters, in combination with pistons, made to act substantially in manner hereinbefore described. Second,—the construction and employment of cutting blades, fixed or bedded spirally in any suitable bed or holder, for cutting laces, substantially in manner hereinbefore described."

To JOHN STENHOUSE, *of Upper Brunswick-terrace, Barnsbury-road, for improvements in rendering certain substances less pervious to air and liquids.*—[Dated 8th January, 1862.]

THIS invention relates to the use of paraffine, either in a solid state or dissolved in any of the usual solvents, for the purpose of rendering various substances less pervious to air and liquids. The substances to which it is proposed to apply the paraffine are leather, and thread, cords, ropes, and textile fabrics, composed of cotton, linen, wool, or silk; and the method of applying the paraffine thereto is by coating or impregnating them therewith.

One way of treating leather and textile fabrics, is as follows:—Take a plate of iron, and heat it to a temperature of from 130° to 250° Fahr., and on it stretch out the cloth or leather to be treated, holding it tight and flat by means of a frame or some other suitable arrangement. When it has become sufficiently warm to soften or melt the paraffine easily, rub over it, on the wrong side of the cloth, a flat rectangular block of solid paraffine, and coat its surface as evenly as possible; then compress the cloth by means of a hot flat-iron or hot rollers, or other suitable arrangement, in order to distribute the paraffine more equally among the fibres. When the coating, or impregnation of the fabric, is completed, it is to be taken off and allowed to cool. Sometimes, instead of a flat block of paraffine, a roller of that material (made by pouring melted paraffine around a wooden core or axis, placed in a suitable mould) is employed. The cloth, which has been previously warmed, is drawn in a contrary direction to the roller, with which it is kept in very close contact by suitable pressure. The thorough incorporation of the paraffine with the cloth is completed by calendering between hot metallic rollers, as in the previous case.

Paraffine can likewise be applied to cloth and leather, by rubbing it on strongly when cold, and then passing a hot iron over its surface; or the patentee takes solid paraffine, and heats it in suitable vessels, to a temperature of from 130° to 250° Fahr. He then heats a plate of iron or other metal, to a temperature considerably above the melting point of paraffine, and on this plate lays a sheet of stout paper or other absorbent material, such as linen, cotton, or woollen cloth, and coats it evenly over with the melted paraffine, by means of a brush or other suitable instrument. The fabric or leather which it is wished to impregnate, he then spreads out on the paraffine surface above mentioned, usually with the wrong side of the cloth downwards, and, if thought desirable, he lays a second paraffined surface upon it, so as to bring the paraffine in contact with both of its sides; the whole of it is then strongly compressed, by means of a hot flat-iron or by passing it between hot metallic rollers. The impregnation being completed, the material is taken out and allowed to cool.

When fabrics of considerable length have to be treated with paraffine,

the process can be made continuous, by passing them over one or more hot wooden or metallic rollers, coated with paraffine, from working in a bath of that substance. The excess of paraffine is removed by a "gauge spreader," having a gauge or knife fixed above it, and furnished with screws, so as to regulate the amount of paraffine applied to the roller. The amount of paraffine can also be regulated by means of a brush or similar apparatus, also acting on a roller, the thorough incorporation of the paraffine and fabric being subsequently completed with hot rollers, by means of which any excess of paraffine can also be removed.

When using solutions of paraffine, it is advisable to dry the substances intended to be treated thoroughly, before applying the solution; and, in cold weather, to warm them, so that they may not chill the paraffine solution. In the case of textile fabrics, threads, and leather—after the greater portion of the solvent has been removed by exposure to heat, it is usually advisable to subject the articles to the action of hot flat irons, or rollers, or other suitable instruments. When textile fabrics, threads, or leather, have been coated, or more or less impregnated with paraffine, in any of the ways above described, they are not only rendered less pervious to air and liquids, but become both stiffer and stronger. Paraffine is, therefore, an excellent finish to certain kinds of textile fabrics. In the case of woollen cloths, dyed with red or any other bright color, the shade is occasionally slightly deepened, sometimes improved, but very seldom deteriorated. Cords and ropes may be impregnated with paraffine by passing them through a paraffine bath, or in any of the ways above described, most suitable to their nature. Mixtures of paraffine with wax, stearine, stearic acid, or any of the other solid fat acids, can also be employed for the same purposes, and applied in the same manner as already mentioned.

The patentee claims, "the employment and application of paraffine, either solid, or in a state of solution, or mixed with wax, stearine, stearic acid, or any of the other solid fat acids, to leather, and thread, cords, ropes, and textile fabrics, composed of cotton, linen, wool, or silk, for the purpose of rendering the same less pervious to air or liquids, as hereinbefore mentioned."

To THOMAS RAMSEY, *of Newcastle-upon-Tyne, for improvements in the manufacture of coke.*—[Dated 11th January, 1862.]

IN the manufacture of coke, the usual custom is to employ small coals, which pass through a half-inch screen or riddle; and various patents have been granted for crushing large coal, to be used for the manufacture of coke in conjunction with tar, lime, and other materials, but this plan consists in reducing large or the small coal described above to the finest state of powder, before converting it into coke.

The patentee prefers to employ rich bituminous or coking coal, which he grinds under edge stones, horizontal stones, or rollers, to a powder almost as fine as flour. Horizontal stones similar to those used in grinding flour, are found to answer best, as all other forms of grinding machinery necessitate the use of riddles or sieves to remove the small pieces which escape the action of the machinery. This finely-ground coal is then put into the coke ovens, and burnt in the ordinary manner

with the usual precautions. The coke obtained is much more dense and hard than that obtained by any of the other processes, and leaves, before being sent away, a smaller quantity of broken pieces known in the trade under the name of breeze. These small pieces are reduced to the same state of powder as the coal, and mixed therewith when necessary; the mixture being converted into large coke in the ordinary coke ovens. Although bituminous coal is preferred to be used, the plan is equally applicable to semi-bituminous coal, or coals known as steam, gas, or house coal. Those coals which do not cake, or only imperfectly, such as anthracite, can be converted into superior coke when reduced to this fine degree of powder, and mixed with equally fine bituminous coals, in proportions varying with the character of the coal. Any form of coke oven—long, square, or round, and of any shape—may be employed in using this finely-divided coal.

The patentee claims, "the use of coal entirely reduced to a fine powder in the manufacture of coke."

To Henry Davis Pochin, *of Salford, for improvements in the manufacture of rosin soap or soda.*—[Dated 4th January, 1862.]

These improvements consist in producing a rosin soap in a more concentrated, economical, and portable form than has hitherto been done, and in producing, by means of such soap, a size of greater efficiency in the manufacture of paper than any hitherto in use. A compound of rosin and alkali has been, and is now, largely used in conjunction with some aluminous salt for sizing paper; but to produce a good size, it is essential that the rosin in combination with alkali should bear a specific relation to the alumina in the aluminous salt; and to produce an economical size it is necessary that the alkali combined with rosin should be so proportioned to the acid in the aluminous salt, that the whole of the rosin and alumina employed are precipitated in the sizing engine, and retained in the pulp. In the ordinary process employed for sizing paper, these conditions are not fulfilled, but they may be secured with certainty and regularity by using the anhydrous rosin soap.

The anhydrous rosin soap is thus prepared:—Take the ordinary rosin of commerce, and having freed it as far as possible from all foreign matter by careful straining, grind it to a fine powder, and mix it intimately with soda-ash, or pearlash, in quantities varying with the chemical constitution of the aluminous salt with which it is intended to be used, as well as with the quality and character of the paper to be sized, but in every case with a quantity of alkali sufficient, when combined, to form a soap soluble in cold water. Next, place this mixture of rosin and alkali in a pan and heat it, either with steam or fire heat, until complete combination has been effected. When cold, break it up into small pieces, or grind it to a powder. Or the mixture of rosin and alkali, when allowed to remain at rest in intimate contact, will combine without the assistance of any artificial heat. If prepared in this way, it is preferred to mix several tons of the material at one time, and allow them to lie in a heap for four or five days, when combination will have been effected. If this combination proceed too slowly, it may be started by a gentle heat, such as may be imparted by means of a steam pipe.

The best mode of making the size, which the patentee terms "Dalton size," is as follows:—Dissolve a certain quantity of anhydrous soap in water, and add thereto an aqueous solution of patent aluminous cake, ammonia, alum, or other aluminous salt. The proportions of aluminous matter with which the preceding material is mixed, when making the size, will vary with the character of the paper to be sized. The following are the proportions best adapted for the purpose:—First, for papers of a common class, the rosin soap consists of 150 parts of rosin and 75 parts of soda ash, such ash containing 46 per cent. of alkali. In making the size for such papers, 10 parts, by weight, of the soap is used with 8 parts of the patent aluminous cake. If ammonia alum be used, 10 parts of rosin soap, combined with 11 parts of such alum, will form a size of a similar kind. For papers of a fine kind, such as writing papers, the rosin soap is made by mixing 165 parts of rosin, with 165 parts of soda ash, the soda ash containing 46 per cent. of alkali. And for forming the Dalton size, 10 parts of such soap are mixed with 13 parts of aluminous cake, or 18 of ammonia alum. If a more acid salt of alum than either of those above mentioned is used in making this size, the amount of alkali in the soap must be increased in proportion. If a more neutral salt—such as cubical alum—is used, the alkali in the soap must be reduced in a corresponding ratio, so as to maintain the relative proportions between the acid and alkali, as given above.

The patentee claims, "the sole right to make, use, exercise, and vend an anhydrous rosin soap and Dalton size, produced substantially as above described."

Scientific Notices.

ROYAL INSTITUTION OF GREAT BRITAIN.

At the Friday Evening Meeting, May 23rd, the DUKE OF NORTHUMBERLAND, K. G., F. R. S., President, in the Chair, the Lecture delivered was "*On Coal*," by WARRINGTON W. SMYTH, Esq., F.R.S.

THE speaker commenced by proposing to select one portion only of a very large subject; and, neglecting chemical and statistical and mining particulars with reference to this important mineral, to confine himself to the physical conditions under which it is found to occur. The enormous value of the coal of this country might be understood from the simple facts that nearly 300,000 of our fellow-subjects find their employment in the coal-mines; and that the total quantity raised in 1860 amounted to no less than eighty-four millions of tons.

Mr. Smyth then proceeded to describe the nature of the various substances with which the coal is associated, referring to specimens on the table from the field of South Yorkshire. Comparison was made between the total thickness of carboniferous rocks or coal measures of different districts, as well as between the total thickness of coal (in the aggregate of the seams); and hence, it was shown, we have one reason for not estimating the value of a coal-field merely by its area, as we find it laid down in a geological map. Thus, the well-known Durham

field, with a thickness of measures of about 2000 feet, has a total thickness of coal of 50 feet. The Derbyshire, 2000, and almost twice the thickness of coal; the North Staffordshire, 6000 feet of measures, and 130 of coal; whilst the South Welsh and Saarbrücken fields exhibit thicknesses of 12 to 15,000 feet, with a proportionate increase (especially in the latter) of coal.

A second reason for mistrusting area as a criterion of the importance of a coal district, is the various forms into which the coal measures have been thrown or moulded by agencies operating at a later date in the earth's crust, whence some districts may exhibit by outcrops an indication of the full amount of their entire contents, whilst in others the beds pass with a gradual inclination beneath newer formations, through which they may nevertheless be accessible. As instances of this were quoted the vast accession of mineral wealth added, even in the last twelve years, to the Westphalian coal-field, by the explorations carried out through the covering of cretaceous rocks which clothe the northern side of the coal-field, and the remarkable pit lately completed by the Duke of Newcastle, at Shireoak, which commenced at a distance of several miles from any visible coal-measures, pierced the new red sandstone and magnesian limestone, and reached the "top-hard" coal at 515 yards in depth.

Mr. Smyth then described certain physical features produced in the coal seams subsequently to their consolidation, such as the *cleat* and *backs*, or various nearly vertical divisions, often more or less filled with carbonate of lime or iron pyrites, which add greatly to the amount of ash and clinker.

In referring afterwards to the principal families of plants which are found either in, or associated with, the coal, he wished to show that their occurence throws a light on the origin of the coal seams, which again becomes an important guide in enabling us to judge of the continuity of various fields,—a question fraught with vital importance, in consequence of the rapid rate at which some of them are being exhausted. Thus the position of the stigmaria in the under-clay or floor of the seam, and of the stems of *Sigillaria*, *Lepidodendron*, *Calamites*, &c., in the roof strata, point to the probability of the growth of the vegetable matter *in situ*. The existence of numerous upright stems, and especially those occurring so often and so dangerously to the miners in the roof of certain coals, is a strong confirmation of the gradual depression of the tract in which these plants grew; and Göppert has shown that the careful examination of a number of seams proves the existence in the coal itself of every family of plant which has been met with in the coal measures.

Thus much had referred to the true carboniferous period, in which it is commonly supposed that a vigorous vegetation first arose, but the speaker described his finding, a few months since, in the Laxey lead and copper mine, in the Isle of Man, at 120 fathoms deep, a seam of anthracite coal, three to four inches thick, in the midst of ancient schists, probably Lower Silurian. He then referred to coaly and lignitic beds in newer formations, especially to the tertiary brown coal, which in continental, and especially in Southern Europe, attains to great importance. The excellent preservation of the vegetable remains in the lignite has enabled Unger and Heer to make accurate comparison with

existing floras, and to show that the tertiary flora had nothing in common with our present flora in Europe, but an extraordinary resemblance to that of modern North America. This was especially to be noticed in closely similar species of the genera *Liquidambar*, *Liriodendron*, *Pavia*, *Nyssa*, *Robinia*, *Taxodium*, *Sequoia*, *Juglans*, *Glycyrrhiza*, *Cercis*, *Laurus*, *Rhododendron*, *Cissus*, and certain oaks and pines. There was hence no retreating from the conclusion, that at this portion of the tertiary period, a land communication must have existed between America and Europe. Fragments of that land, with relics of the same tertiary flora, still exist in Iceland and the Azores, with their *surturbrand* and lignites; and thus, that Atlantis, which is generally set down as a dream of the poets, is brought again into solid existence by the studies of the geologist. A relation of this kind at a comparatively recent period, throws a light on the causes of phenomena belonging to an earlier epoch, and will enable us to form conclusions, if not upon the absolute contemporaneity of certain beds or groups of coal measures, at all events upon the physical connection, within a given period, of the agencies which were forming coal not only in the various fields of Europe, but also in North America: and the speaker concluded by pointing out that the reasoning on the continuity among one another of our British coal fields, or of them with those of Belgium and North France, depends on somewhat complex data, which scientific investigation can alone afford.

On Friday Evening, May 30, the following lecture "*On a plea for cotton and for industry*," was delivered by THOMAS BAZLEY, Esq., M.P.

THE fact of the cotton trade in this country being dependent chiefly upon one source of supply for its raw material, has been at all times the cause of anxious solicitude to the thoughtful observer of the nation's progress; but the dilemma in which that great industry is now placed by that sole dependence deserves the consideration alike of the statesman, of the economist, of the merchant, of the employers of labour, and of the humane and patriotic public. Between cotton and labour, there was formed in Lancashire, three-quarters of a century ago, an alliance which, combining mechanical with manufacturing skill, has created an industry unparalleled in any other country.

Little more than a century since, the clothing comforts of the masses of the people were few in this country, and the abundant luxuries which now prevail were to them almost unknown. The prepared skins of animals were, up to that recent date, largely used in the clothing of the peasant, and in every house and hamlet the distaff and spindle, and the weaving loom, ministered to the supply of linens, woollens, and their mixture, in aid of domestic wants. In the reign of Elizabeth, her subjects were only equal in number to the inhabitants of Lancashire and Yorkshire at the present time, and greatly below the people of those two counties, with Cheshire added. The British people under Elizabeth were powerful, and in splendour and position ranked with the highest nations of the earth; yet her army, navy, aristocracy, court, and people, did not exceed that portion of Queen

Victoria's subjects, who directly and indirectly subsist upon the toils, industry, and capital of the cotton trade. The kingdoms of Belgium, Portugal, Holland, and Hanover do not separately contain populations as extensive as the cotton trade supports in Great Britain; hence this industry of five millions of dependents, sustained by no separate regal power, and hitherto happy and prosperous as a portion of the subjects of our gracious Sovereign, may claim to be at least of some national importance. About three centuries ago, the whole people of this country might be equal to the five millions who now subsist by the manipulations, products, and commerce of cotton; but at this moment the population of the United Kindom may be regarded as thirty millions, yet the same circumscribed and limited extent of land only exists to afford them the means of labour, and to yield them its fruits which supported their predecessors. Even in Elizabeth's reign, the people were deemed to be too numerous for the extent of land in her British dominions, and restrictions upon the building of dwellings in proportion to the areas of districts were enacted. If, therefore, the augmentation within the period now mentioned, of from five to thirty millions of people, be considered, it is self-evident that new sources of industry have had to be developed to supply increasing wants. Mineral and agricultural products, in past ages, furnished scanty exports to pay for foreign articles of necessity and luxury; but, with a constantly increasing population, the yield of the soil has been absorbed by the large consumption at home; and now foreign supplies of corn, of other food, and of luxuries, are required for, and may be equal to the subsistence of one-third of the entire population of the United Kingdom. But whilst supplies of food have been needed for this increasing population, the other concomitants of comfort have also been required, and all these necessaries of life could only be obtained in this country by the magic power of skill and labour.

A sea-girt land with navigable rivers, thus possessing egress and ingress, seems to invite foreign intercourse, and to be the first essential to a great mercantile and manufacturing district; but when such a country is found to be immeasurably rich in its mines of coals and metals, when it possesses a temperate and healthy clime, and, above all, when its inhabitants are hardy, sagacious, toil-loving, free, and untiring, we may infer that the decree of Providence has ordained that the people with these advantages shall be blest with plenty, and shall contribute of their abundance to the families of mankind. To no country, however, has exclusive advantages been given; but, wisely, mutual dependence appears to be the pacific bond intended to promote the welfare of the common brotherhood. Probably beyond every other people, the British possess the elements of successful trading and commercial industry; but beyond the direct necessaries of life, which their labour ought to enable them to buy, they need raw materials whereon that labour can be employed. Sheep's wool and flax, Great Britain can, in part, produce towards the demand for them; but still large quantities of them are required from foreign countries, and silk, cotton, and other productions of the warmer regions must always be imported as contributions in aid of the manufacturing industry of the United Kingdom. Textile fabrics afford in their production the most extensive means of employment, and have become the indispensable

clothing comforts of the people of every country. The fabrics and manufactures of cotton are, however, among the most useful, convenient, elegant, and economical productions of labour. From the quilt or bed-cover to the finest and most filmy muslin—from the fustian garments of the poor to the decorations of lace worn by the rich—and in the snow-white gift of the bleacher to the rainbow colours of the printer—cotton is prolific of comfort and ornament.

The persecutions of the Duke of Alva had banished from their homes the Flemish weavers, who took refuge in Britain. These skilful and ingenious workmen became valuable acquisitions in a country commencing the transition from the labours of the field to those of the loom; and the domestic manufactures of our country began to indicate the progress and perfection which they were destined to attain. The dawn of a great industry was perceptible. Industry was honoured, and labour inculcated as the foundation of the nation's coming distinction and prosperity. Even more than two centuries ago, when steam-engines were unknown, canals not having been formed, nor large manufacturing establishments erected, and while deer-forests surrounded this vast city, there were merchants who promulgated sound economical principles, and who taught lessons of wisdom to the possessors of regal power. In London, in 1641, Roberts, a son of commerce, published an enlightened pamphlet, entitled "Treasures of Traffic," and in proof of the soundness of his views, the following extract cannot fail of being interesting and welcome. He said,—"Some princes are not satisfied with those materials that grow among themselves, and in their own countries, but they covet by all industry to draw others from their neighbours, or foreign nations, to employ their subjects, and to put their people on work, by this means much enriching themselves, and honouring their country; and adding a great help to the public traffick thereof, selling and venting them thus wrought, even to those nations who many times have sold and furnished them with the very first materials of the said manufactories." "Manchester, in Lancashire, must also herein be remembered, and worthily, and for their industry commended, who buy yarn of the Irish in great quantity, and weaving it, return the same again in linen, to Ireland to sell. Neither doth the industry rest here, for they buy cotton wool in London, that comes first from Cyprus and Smyrna, and at home work the same, and perfect it into fustians, vermillions, dymities, and such other stuffs, and then return it to London, where the same is vented and sold, and not seldom sent to foreign parts." Thus at a period in English history when Charles the First was surrounded with troubles, discord and distress prevailing, Roberts, in beautiful simplicity of language, uttered the first plea for cotton and for its industry, thereby throwing a lustre upon his own name and upon the seventeenth century.

In the middle of the eighteenth century, a considerable home manufacture had arisen. Cotton was spun by hand, and afterwards blended in the loom with linen or woollen, thus producing a mixed fabric. The supply of cotton was then inconsiderable, and was obtained from Turkey and the Levant, and from the West Indies. Mechanical science now escaped from the libraries and traditions of the learned, and offered practical aid to the infant industry. Such a galaxy of talent and inventive genius as then stood forth to develop new methods of increasing the

comforts both of the palace and of the cottage, the world had not seen. By an almost mysterious combination of efforts, Hargreaves, Whyatt, Arkwright, and Crompton were devising their several systems of spinning cotton; Watt was rendering available the majestic power of vapour, directing, controlling, and dooming it to become the universal drudge of man; Scheele and Berthollet, with their oxygenated muriatic acid, blanched the calico and the cambric; and the Mauvillions, Nixons, and Peels gave their coloured tints to print these new fabrics; and as if inspired by the inventions which sprang from the east of the Atlantic, the Anglo-Saxon in the United States of America originated the cultivation of cotton in that great territory: but in giving this boon, by the production of slave labour, he conferred the bane whence the vast cotton industry now suffers, in the deprivations inflicted upon labour and capital. In the year 1700, when mechanical appliances were comparatively unknown in the manufacture of cotton, the consumption of this material might be one million pounds weight; but in 1860, the quantity had culminated in the consumption of one thousand millions pounds weight in that year. Cotton began to arrive from America in 1787, in sufficient quantity to prove the power of the States to produce it, and in that year Crompton triumphed over his mechanical difficulties and completed the mule,—this machine being the great agent at the present time for the production of coarse as well as of fine yarns; but spinning by rollers, and Arkwright's throstle spinning frame, had been invented twenty years previously; hence the history of the modern and mechanical cotton trade may be dated from this period.

Eighty years ago the cotton industry of our country was thus initiated, and from that time to the present, progress, improvements, and extension have characterized it. The science, skill, and invention which have accompanied its development are wonderful. It has afforded employment, comfort, and prosperity to many millions of the people of this country during that period, and it has contributed very largely to the national revenue. During the great struggle with the first Napoleon, our men were able to leave their country for the strife of war, and yet the steam-engine and the mechanical agencies which existed at home more than compensated for their physical loss; but here was the waste of the nation's strength. Wiser would it have been had these new resources been developed for the moral, mental, and social improvement and comfort of the people at large. Most probably the cotton trade and the development of new mechanical powers, have enabled the people of this country to sustain a system of taxation which, without that trade and those treasures, could not have been borne, and have supported a national expenditure alike extravagant and injurious. The state, therefore, has participated in the contributions of all who have promoted and sustained this industrial fabric.

The capitalists of this trade have now two hundred million pounds sterling invested in it, in fixed and floating property; and the people directly and indirectly employed in it being now five millions, we arrive at the important deduction that not only does the national exchequer derive great benefit from it, but we have capitalists and labourers supported by it as numerous as are the people of several European kingdoms of the present time. Indifferent spectators of the abundance which has happily prevailed in this country since the introduction of

the liberal commercial policy which is now established, rarely reflect upon the obligations this vast industry has conferred in aid of the elements of social comfort. Of late years, the exports in cotton manufactures have been about fifty millions sterling per annum, or about one-third of the gross exports of the United Kingdom. Well, then, as cotton exports constitute one-third of the whole, it becomes evident that cotton buys one-third of the imports; hence, as gold, silver, gems, coffee, tea, sugar, tobacco, wine, oil, and the fruits of sunny climes, as well as corn and other food brought hither, are foreign products largely imported into the United Kingdom, we must claim the merit for the cotton trade of having bought and paid for one-third of these exotic and foreign supplies. In 1860, the last year of active and full employment for the whole of the cotton trade, its manufactured products exceeded eighty millions sterling in value, something more than fifty of which were exported, leaving about thirty millions as the value of the home consumption of cotton manufactures; but as this latter sum will about equal the cost of the raw cotton imported, the beneficial interest of the country in the cotton industry will be represented by its export trade of upwards of fifty millions sterling. That so extensive and prosperous an industry should have been founded upon the supply of a foreign product, is not the least wonderful fact of its history; but that cotton should have been almost exclusively, as it has been, obtained from almost adverse sources, is a great reproach to the British nation.

Of the 2,523,000 bags of cotton consumed in this country in the year 1860, 85 per cent. consisted of the growth of the United States, 8 per cent. of the growth of Egypt, Brazil, and other foreign districts; whilst of cotton from the British East and West Indies the consumption was only 7 per cent.! In consequence of the convulsion in the States of America, the consumption of cotton in Great Britain, in 1861, resulting from its contracted supply and the loss of the American markets for its manufactured products, diminished 10 per cent.; and whilst of American and other foreign cotton the consumption became only 85 per cent. against 93 per cent. in the previous year, the consumption of East Indian cotton was 15 per cent. against the previous 7 per cent.; but of the present diminished consumption probably 75 per cent. may be East Indian. A very rapid increase has been effected in the consumption of East India cotton, which, in 1860, was 3500 bags per week, in 1861, 7000 bags, and in this year is proceeding at the rate of 15,000 bags, or more, per week, showing the increase to be 100 per cent. per annum upon each successive year. The actual power of consuming cotton in the United Kingdom is 55,000 bags per week; but, lacking the requisite supply, the present total consumption cannot exceed 25,000 bags per week.

Such, then, having been the rise, progress, productive and consuming power of the cotton trade, are we blameless for allowing this immense industry to exist and extend upon the frail basis of slavery upon which it has largely depended?

How fearful is the contemplation of a people, whose labours, directed by intelligence and right principles, having supported them with abundance, and still able and willing to work, being deprived of the material on which their industry has been advantageously engaged? The

deprivations in this great industry have become lamentably severe. With less than half a supply of raw material, and at the enhanced cost of a whole supply, only half employment can be afforded, and consequently only half wages, or less, can be earned. Already the working classes of the cotton trade are subjected to diminished earnings of a million pounds sterling per month. Generally, the mills are working half-time, but many are wholly stopped, whilst a very few continue to give full employment, but the average time now worked will be the half-time now stated; and the consumption of cotton is only 25,000 bags weekly instead of the 55,000 bags capable of being consumed; but in this latter quantity is included the probable consumption of many new mills which have not begun to work. Of the consumption of cotton at the present moment, the East Indies supply 75 per cent., 12½ per cent. is America, and 12½ per cent. other foreign kinds. Last year the East Indies were exhausted of the stocks of cotton usually held there, and it is doubtful whether the million bales then received can be repeated this year. No efforts to obtain cotton from new fields, commensurate with the necessity, are being made.

In 1848 Mr. Bright, M.P. for Birmingham, proved by his parliamentary committee the capability of the East Indies to grow and supply abudantly most excellent cotton. With many men of experience, I gave evidence before that committee; but apathy in the Government, in the trade, and in the public mind, has caused to be neglected the admonitory facts then elicited.

Essentially, Great Britain possesses the monopoly of the best land found in the world for the growth of cotton. In the East Indies, the policy, under the rule of a nominally commercial company, has been absurdly political and despotic. The material prosperity of the people was neglected; navigation, by improving the rivers, has been discouraged; few canals have been formed; roads have scarcely existed; ample means for irrigation have been withheld; quays are almost unknown; and the land held by Governmental feudal power has been largely unproductive. By the small water supplies of Colonel Sir Arthur Cotton, immense benefits have been derived in Madras, and, by the recent changes in land tenure, great improvements will doubtless result. Railways are now being established, and the general indications of the great dependency are becoming favourable for the extension of cotton and other agriculture, and for trade and commerce. For many years the improved navigation of the Godavery has been a subject of contention and of hope deferred. This river ought to connect the great cotton-fields of Berar with Coringa and other ports, in Madras. The rocky barriers of the Godavery should be either removed, or they should be avoided by the aid of short links of canals, or by tramways. To what extent the works of the Godavery have proceeded we are ignorant, but the advantages which would accrue from their completion cannot be overstated. Its fertile valley would yield immense supplies of excellent cotton and other products; the markets to ten or twelve millions of people being opened would yield double advantages, alike to a home and a foreign trade. On the banks of that river, at Ingelhaut, cotton of most acceptable quality to the British spinner is already grown; and in its vicinity, as also in Berar, cottons could be cultivated which would equal, if they did not

surpass, the productions of New Orleans. Of the power of the East Indies to produce superabundant supplies of most excellent cotton, no doubt need be entertained. The communications within that vast dependency being effectively extended to its sea-board in every direction, its agriculture being industriously conducted by the aid of practical science, and the government of it becoming wise and just, benefits would flow from and to it, fructifying and enriching the whole empire. In 1860, the imports of cotton from the East Indies were 561,200 bags, of which two-thirds were exported, and in 1861 there came 986,600 bags, or nearly double the previous year's supply; but though the importers of this enlarged import have derived very great profits by the advance which has taken place in the price of cotton, the ryot, or farmer, in India, has not yet importantly obtained any advantage from the increased value of his produce; but if the communication with the interior of India, both as to intelligence and the conveyance of cotton, be facilitated, then the ryot will be stimulated, by compensating and increased rewards, to extend the cultivation of cotton, and to improve the quality of it. As now stated, ample proof exists that India can grow most excellent cotton, and many supplies of very useful qualities have been thence received; and I now have the satisfaction of placing before this meeting a sample of superior cotton sent by Dr. Short, from Chingleput, in Madras. I am also enabled to display some very good yarns, of above the average fineness, being 60*s*. warp and 80*s*. weft, spun from it by Mr. Kirkpatrick, at his mills near Manchester.

A Cotton Supply Association was formed in Manchester a few years ago, and its labours are constantly directed to obtain corrective measures for the evils of India, and to promote the growth of cotton wherever the soil and climate of any country will enable it to be produced. This association has impelled a wiser policy for India, and has rendered valuable services to that dependency and to other countries; having made grants to upwards of 400 places of cotton seeds and of cleaning gins, besides other agricultural implements. By the exertions of this body, small supplies of cotton have been received from many new fields of cultivation. Cotton growing is being slowly resumed in the British West Indies, whence encouraging supplies are now received; but if the proprietors of estates in those islands did their duty to themselves and to their country, an enlarged production of excellent cotton would compensate them and contribute to the nation's prosperity. The fine island of Jamaica, which could produce very large quantities of superior cotton, is a territorial wreck; but see the capability of this island by this sample of cloth make from its cotton. Demerara, and other neighbouring possessions, can produce more cotton than the United Kingdom could manufacture. From the Cape of Good Hope to Port Natal cotton can be abundantly produced. Africa has of late years sent small, but valuable supplies of cotton, of qualities quite equal to the produce of New Orleans; but her Egyptian cotton has, from the time of Mehemet Ali to the present moment, been a large and most welcome contribution. If the million per annum, which our fleet for the suppression of slavery costs, had been devoted in our own colonies, or even in Africa, to the encouragement of the growth of cotton, sugar, and other products, which the labour of the negro in slavery has yielded, then that disgraceful traffic in human beings might have been annihilated, and our own

pursuits untainted with the wrongs inflicted upon the colored race. Australia, however, has amazing powers for the production of cotton. and in sections of that great country—Queensland, Victoria, and New South Wales—cotton of every class, from the lowest to the highest, might be cultivated and produced beyond the wants of all the world. Queensland has sent small lots of cotton of unsurpassed beauty and excellence, and from this colony, and from New South Wales, samples of cotton may be seen in the great International Exhibition of qualities adapted to the production of the finest muslins and laces which any skill could manipulate, as may be seen by this beautiful specimen of lace made from it. Labour appears to be almost alone the sole requisite for obtaining supplies of cotton of incalculable extent from Australia. On referring to the cultivation of cotton in America, we learn that there one million of negroes can produce cotton of nearly twice the extent of its consumption in great Britain, consequently half a million of labourers would suffice to produce the cotton needed by the latter; and the question arises whether it would not be an act of prudence and of wisdom to induce this number of Chinese men, women and children to become cotton-growing labourers in Australia. In the States of America, only about one quarter of the negro population is there engaged in cotton agriculture, the large majority being employed in producing tobacco, rice, sugar, Indian corn, and in handicraft and domestic pursuits or occupations. The Emperor of France has wisely offered great inducements for the growth of cotton in Algiers, whence very superior cotton is already supplied. That French colony is within a single week's sail of this country, and some eminent men of business here and in France are endeavouring to extend the cultivation of cotton in it, which, if judiciously carriedo ut, cannot fail to become of vast advantage to all the relations of both countries.

With these facts, the power abundantly to produce cotton, not only in British possessions, but in many foreign states, is beyond all doubt.

By the general neglect of cotton agriculture, an aggregation of evils now exists which can only be contemplated with profound grief and apprehension. Probably 100,000 labourers, who have usually shared the employment afforded in the cotton trade, are now totally idle and penniless. 300,000 more are working short time, and in the sympathetic branches much deprivation prevails. The losses of the labouring classes are one million pounds sterling per month, or twelve millions per annum; whilst the employing classes are, by loss of rents, interest of money on stagnant capital, and in suspended operations, without computing anything for loss of profit, sustaining a loss equal to eight millions per annum, thus making the certain loss, in labour and capital, into twenty millions sterling per annum; but the great infliction of double price for cotton, which adds eighteen millions per annum to its normal market cost, subjects the trade to a drain of nearly forty millions per annum, and to an exhaustion tending almost to extermination. Cotton-spinning and manufacturing in Great Britain, are equal in extent to those pursuits carried on in America and upon the continent of Europe. Consequently, in the British and foreign cotton trades, the losses and disadvantages will be double the extent stated for this country alone. A plea, then, for cotton and for industry becomes a duty and a necessity.

Seeing, therefore, the extent of distress existing in the districts of the cotton manufacture, and that increased deprivations may inflict deeper misery upon the labouring classes, whilst many capitalists may be on the verge of total ruin, and seeing also that the people of the United Kingdom generally sympathize with the sufferings in the cotton trade, what assistance can be rendered to this apparently decaying industry is a question that many benevolent individuals will ask. Will not the British Government and people best remove present and future evils by assisting to develop the resources of their colonies, which, by the introduction of cotton cultivation upon a large scale, would be rendered productive and prosperous?

Shall no attempts, commensurate with the wants of this great industry, be made to obtain adequate supplies of cotton, and at the same time to benefit the dependencies and colonies of Great Britain? No charity can compensate for the losses now sustained, and effectual relief can only proceed from an abundant supply of good and cheap cotton.

A moral truth has now been taught the world—that slavery and tyranny shall not permanently yield prosperity; and the wrongs of the oppressed, crying for justice, indicate that retribution is the corrective of iniquity. Experience and the physical construction of the earth both tell us that without adequate exertions there can be no beneficial result; and consequently, in this great country, when dangers are threatening extinction to any portion of the community, efforts must be called forth to sustain the social and industrial fabric, to contribute to the means of labour, to promote commerce, to extend civilization, and still to raise our national aims in the cause of humanity and of universal justice; that should prosperity again shine upon our country, there may be, in our distant intercourse and relations, no leading into captivity, and, at home, no complaining in our streets.

On Friday evening, June 6th, the following lecture, "*On Force,*" was delivered by Professor Tyndall, F.R.S.

The existence of the International Exhibition suggested to our Honorary Secretary the idea of devoting the Friday evenings after Easter of the present year to discourses on the various agencies on which the material strength of England is based. He wished to make iron, coal, cotton, and kindred matters, the subjects of these discourses,—opening the series by a discourse on the Great Exhibition itself; and he wished me to finish the series by a discourse on "Force" in general. For some months I thought over the subject at intervals, and had devised a plan of dealing with it; but three weeks ago I was induced to swerve from this plan, for reasons which shall be made known towards the conclusion of the discourse.

We all have ideas, more or less distinct, regarding force; we know, in a general way, what muscular force means, and each of us would less willingly accept a blow from a pugilist than have his ears boxed by a lady. But these general ideas are not now sufficient for us; we must learn how to express numerically the exact mechanical value of the two blows—this is the first point to be cleared up.

A sphere of lead, weighing 1 lb., was suspended at a height of 16 feet above the theatre floor. It was liberated, and fell by gravity. That weight required exactly a second to fall to the earth from that elevation; and the instant before it touched the earth, it had a velocity of 32 feet a second. That is to say, if at that instant the earth were annihilated, and its attraction annulled, the weight would proceed through space at the uniform velocity of 32 feet a second.

Suppose that, instead of being pulled downward by gravity, the weight is cast upward in opposition to the force of gravity, with what velocity must it start from the earth's surface in order to reach a height of 16 feet? With a velocity of 32 feet a second. This velocity imparted to the weight by the human arm, or by any other mechanical means, would carry the weight up to the precise height from which it has fallen.

Now the lifting of the weight may be regarded as so much mechanical work. I might place a ladder against the wall, and carry the weight up a height of 16 feet; or I might draw it up to this height by means of a string and pulley; or I might suddenly jerk it up to a height of 16 feet. The amount of work done in all these cases, as far as the raising of the weight is concerned, would be absolutely the same. The absolute amount of work done depends solely upon two things—first of all, on the quantity of matter that is lifted; and, secondly, on the height to which it is lifted. If you call the quantity or mass of matter m, and the height through which it is lifted h, then the product of m into h, or mh, expresses the amount of work done.

Supposing, now, that instead of imparting a velocity of 32 feet a second to the weight, we impart twice this speed, or 64 feet a second. To what height will the weight rise? You might be disposed to answer, "To twice the height;" but this would be quite incorrect. Both theory and experiment inform us that the weight would rise to four times the height: instead of twice 16, or 32 feet, it would reach four times 16, or 64 feet. So, also, if we treble the starting velocity, the weight would reach nine times the height; if we quadruple the speed at starting, we attain sixteen times the height. Thus, with a velocity of 128 feet a second at starting, the weight would attain an elevation of 256 feet. Supposing we augment the velocity of starting seven times, we should raise the weight to 49 times the height, or to an elevation of 784 feet.

Now the work done—or, as it is sometimes called, the mechanical effect—as before explained, is proportional to the height, and as a double velocity gives four times the height, a treble velocity nine times the height, and so on, it is perfectly plain that the mechanical effect increases as the square of the velocity. If the mass of the body be represented by the letter m, and its velocity by v, then the mechanical effect would be represented by $m v^2$. In the case considered, I have supposed the weight to be cast upward, being opposed in its upward flight by the resistance of gravity; but the same holds true if I send the projectile into water, mud, earth, timber, or other resisting material. If, for example, you double the velocity of a cannon-ball, you quadruple its mechanical effect. Hence the importance of augmenting the velocity of a projectile, and hence the philosophy of Sir William Armstrong in using a 50 lb. charge of powder in his recent striking experiments.

The measure, then, of mechanical effect is the mass of the body multiplied by the square of its velocity.

Now in firing a ball against a target, the projectile, after collision, is often found hissing hot. Mr. Fairbairn informs me that in the experiments at Shoeburyness it is a common thing to see a flash of light, even in broad day, when the ball strikes the target. And if I examine my lead weight after it has fallen from a height, I also find it heated. Now here experiment and reasoning lead us to the remarkable law that the amount of heat generated, like the mechanical effect, is proportional to the product of the mass into the square of the velocity. Double your mass, other things being equal, and you double your amount of heat; double your velocity, other things remaining equal, and you quadruple your amount of heat. Here, then, we have common mechanical motion destroyed and heat produced. I take this violin bow, and draw it across this string. You hear the sound. That sound is due to motion imparted to the air, and to produce that motion a certain portion of the muscular force of my arm must be expended. We may here correctly say, that the mechanical force of my arm is converted into music. And, in a similar way, we say that the impeded motion of our descending weight, or of the arrested cannon-ball, is converted into heat. The mode of motion changes, but it still continues motion; the motion of the mass is converted into a motion of the atoms of the mass; and these small motions, communicated to the nerves, produce the sensation which we call heat. We, moreover, know the amount of heat which a given amount of mechanical force can develop. Our lead ball, for example, in falling to the earth, generated a quantity of heat sufficient to raise the temperature of its own mass three-fifths of a Fahrenheit degree. It reached the earth with a velocity of 32 feet a second, and forty times this velocity would be a small one for a rifle bullet; multiplying $\frac{3}{5}$ths by the square of 40, we find that the amount of heat developed by collision with the target would, if wholly concentrated in the lead, raise its temperature 960 degrees. This would be more than sufficient to fuse the lead. In reality, however, the heat developed is divided between the lead and the body against which it strikes; nevertheless, it would be worth while to pay attention to this point, and to ascertain whether rifle bullets do not, under some circumstances, show signs of fusion.

From the motion of sensible masses, by gravity and other means, the speaker passed to the motion of atoms towards each other by chemical affinity. A collodion balloon, filled with a mixture of chlorine and hydrogen, was hung in the focus of a parabolic mirror, and in the focus of a second mirror, 20 feet distant, a strong electric light was suddenly generated: the instant the light fell upon the balloon, the atoms within it fell together with explosion, and hydro-chloric acid was the result. The burning of charcoal in oxygen was an old experiment, but it had now a significance beyond what it used to have; we now regard the act of combination on the part of the atoms of oxygen and coal exactly as we regard the clashing of a falling weight against the earth: and the heat produced in both cases is referable to a common cause. This glowing diamond, which burns in oxygen as a star of white light, glows and burns in consequence of the falling of the atoms of oxygen against it: and could we measure the velocity of the atoms when they clash, and

could we find their number and weight, multiplying the mass of each atom by the square of its velocity, and adding all together, we should get a number representing the exact amount of heat developed by the union of the oxygen and carbon.

Thus far we have regarded the heat developed by the clashing of sensible masses and of atoms. Work is expended in giving motion to these atoms or masses, and heat is developed. But we reverse this process daily, and, by the expenditure of heat, execute work. We can raise a weight by heat; and in this agent we possess an enormous store of mechanical power. This pound of coal, which I hold in my hand, produces, by its combination with oxygen, an amount of heat which, if mechanically applied, would suffice to raise a weight of 100 lbs. to a height of 20 miles above the earth's surface. Conversely, 100 lbs. falling from a height of 20 miles, and striking against the earth, would generate an amount of heat equal to that developed by the combustion of a pound of coal. Wherever work is done by heat, heat disappears. A gun which fires a ball is less heated than one which fires blank cartridge. The quantity of heat communicated to the boiler of a working steam engine is greater than that which could be obtained from the re-condensation of the steam after it had done its work; and the amount of work performed is the exact equivalent of the amount of heat lost. Mr. Smyth informed us, in his interesting discourse, that we dig annually 84 millions of tons of coal from our pits. The amount of mechanical force represented by this quantity of coal seems perfectly fabulous. The combustion of a single pound of coal, supposing it to take place in a minute, would be equivalent to the work of 300 horses; and if we suppose 108 millions of horses working day and night, with unimpaired strength, for a year, their united energies would enable them to perform an amount of work just equivalent to that which the annual produce of our coal fields would be able to accomplish.

Comparing the energy of the force with which oxygen and carbon unite together, with ordinary gravity, the chemical affinity seems almost infinite. But let us give gravity fair play; let us permit it to act throughout its entire range. Place a body at such a distance from the earth that the attraction of the earth is barely sensible, and let it fall to the earth from this distance. It would reach the earth with a final velocity of 36,747 feet in a second; and, on collision with the earth, the body would generate about twice the amount of heat generated by the combustion of an equal weight of coal. We have stated that, by falling through a space of 16 feet, our lead bullet would be heated three-fifths of a degree; but a body falling from an infinite distance has already used up 1,299,999 parts out of 1,300,000 of the earth's pulling power, when it has arrived within 16 feet of the surface; on this space only $\frac{1}{1300000}$ths of the whole force is exerted.

Let us now turn our thoughts for a moment from the earth towards the sun. The researches of Sir John Herschel and M. Pouillet have informed us of the annual expenditure of the sun, as regards heat; and by an easy calculation we ascertain the precise amount of the expenditure which falls to the share of our planet. Out of 2300 million parts of light and heat, the earth receives one. The whole heat emitted by the sun in a minute would be competent to boil 12,000 millions of cubic

miles of ice-cold water. How is this enormous loss made good? Whence is the sun's heat derived, and by what means is it maintained? No combustion, no chemical affinity with which we are acquainted, would be competent to produce the temperature of the sun's surface. Besides, were the sun a burning body merely, its light and heat would assuredly speedily come to an end. Supposing it to be a solid globe of coal, its combustion would only cover 4600 years of expenditure. In this short time it would burn itself out. What agency, then, can produce the temperature and maintain the outlay? We have already regarded the case of a body falling from a great distance towards the earth, and found that the heat generated by its collision would be twice that produced by the combustion of an equal weight of coal. How much greater must be the heat developed by a body falling towards the sun! The maximum velocity with which a body can strike the earth is about 7 miles in a second; the maximum velocity with which it can strike the sun is 390 miles in a second. And as the heat developed by the collision is proportional to the square of the velocity destroyed, an asteroid falling into the sun with the above velocity would generate about 10,000 times the quantity of heat generated by the combustion of an asteroid of coal of the same weight. Have we any reason to believe that such bodies exist in space, and that they may be raining down upon the sun? The meteorites flashing through the air are small planetary bodies, drawn by the earth's attraction, and entering our atmosphere with planetary velocity. By friction against the air they are raised to incandescence, and caused to emit light and heat. At certain seasons of the year they shower down upon us in great numbers. In Boston 240,000 of them were observed in nine hours. There is no reason to suppose that the planetary system is limited to "vast masses of enormous weight;" there is every reason to believe that space is stocked with smaller masses, which obey the same laws as the large ones. That lenticular envelope which surrounds the sun, and which is known to astronomers as the Zodiacal light, is probably a crowd of meteors; and moving as they do in a resisting medium, they must continually approach the sun. Falling into it, they would be competent to produce the heat observed, and this would constitute a source from which the annual loss of heat would be made good. The sun, according to this hypothesis, would be continually growing larger; but how much larger? Were our moon to fall into the sun, it would develop an amount of heat sufficient to cover one or two years' loss; and were our earth to fall into the sun, a century's loss would be made good. Still, our moon and our earth, if distributed over the surface of the sun, would utterly vanish from perception. Indeed, the quantity of matter competent to produce the necessary effect would, during the range of history, produce no appreciable augmentation in the sun's magnitude. The augmentation in the sun's attractive force would be more appreciable. However this hypothesis may fare as a representant of what is going on in nature, it certainly shows how a sun might be formed and maintained by the application of known thermo-dynamic principles.

Our earth moves in its orbit with a velocity of 68,040 miles an hour. Were this motion stopped, an amount of heat would be developed sufficient to raise the temperature of a globe of lead of the

same size as the earth 384,000 degrees of the centigrade thermometer. It has been prophesied that "the elements shall melt with fervent heat." The earth's own motion embraces the conditions of fulfilment; stop that motion, and the greater part, if not the whole, of her mass would be reduced to vapour. If the earth fell into the sun, the amount of heat developed by the shock would be equal to that developed by the combustion of 6435 earths of solid coal.

There is one other consideration connected with the permanence of our present terrestrial conditions, which is well worthy of our attention. Standing upon one of the London bridges, we observe the current of the Thames reversed, and the water poured upward twice a-day. The water thus moved rubs against the river's bed and sides, and heat is the consequence of this friction. The heat thus generated is in part radiated into space, and then lost, as far as the earth is concerned. What is it that supplies this incessant loss? The earth's rotation. Let us look a little more closely at the matter. Imagine the moon fixed, and the earth turning like a wheel from west to east, in its diurnal rotation. Suppose a high mountain on the earth's surface; on approaching the moon's meridian, that mountain is, as it were, laid hold of by the moon, and forms a kind of handle by which the earth is pulled more quickly round. But when the meridian is passed, the pull of the moon on the mountain would be in the opposite direction—it now tends to diminish the velocity of rotation as much as it previously augmented it; and thus the action of all fixed bodies on the earth's surface is neutralized. But suppose the mountain to lie always to the east of the moon's meridian, the pull then would be always exerted against the earth's rotation, the velocity of which would be diminished in a degree corresponding to the strength of the pull. The tidal wave occupies this position—it lies always to the east of the moon's meridian, and thus the waters of the ocean are in part dragged as a brake along the surface of the earth; and as a brake, they must diminish the velocity of the earth's rotation. The diminution, though inevitable, is, however, too small to make itself felt within the period over which observations on the subject extend. Supposing then that we turn a mill by the action of the tide, and produce heat by the friction of the millstones; that heat has an origin totally different from the heat produced by another mill, which is turned by a mountain stream. The former is produced at the expense of the earth's rotation, the latter at the expense of the sun's radiation.

The sun, by the act of vaporization, lifts mechanically all the moisture of our air. It condenses and falls in the form of rain,—it freezes, and falls as snow. In this solid form it is piled upon the Alpine heights, and furnishes materials for the glaciers of the Alps. But the sun again interposes, liberates the solidified liquid, and permits it to roll by gravity to the sea. The mechanical force of every river in the world, as it rolls towards the ocean, is drawn from the heat of the sun. No streamlet glides to a lower level without having been first lifted to the elevation from which it springs by the mighty power of the sun. The energy of winds is also due entirely to the sun; but there is still another work which he performs, and his connection with which is not so obvious. Trees and vegetables grow upon the earth, and when burned they give rise to heat, and hence to mechanical

energy. Whence is this power derived? You see this oxide of iron, produced by the falling together of the atoms of iron and oxygen; here also is a transparent gas which you cannot now see—carbonic acid gas—which is formed by the falling together of carbon and oxygen. These atoms, thus in close union, resemble our lead weight while resting on the earth; but I can wind up the weight and prepare it for another fall; and so these atoms can be wound up, separated from each other, and thus enabled to repeat the process of combination. In the building of plants, carbonic acid is the material from which the carbon of the plant is derived; and the solar beam is the agent which tears the atoms asunder, setting the oxygen free, and allowing the carbon to aggregate in woody fibre. Let the solar rays fall upon a surface of sand; the sand is heated, and finally radiates away as much heat as it receives; let the same beams fall upon a forest, the quantity of heat given back is less than the forest receives, for the energy of a portion of the sun-beams is invested in building up the trees in the manner indicated. Without the sun, the reduction of the carbonic acid cannot be effected, and an amount of sunlight is consumed exactly equivalent to the molecular work done. Thus trees are formed; thus the cotton, on which Mr. Bazley discoursed last Friday, is formed. I ignite this cotton, and it flames; the oxygen again unites with its beloved carbon; but an amount of heat equal to that which you see produced by its combustion was sacrificed by the sun to form that bit of cotton.

But we cannot stop at vegetable life, for this is the source, mediate or immediate, of all animal life. The sun severs the carbon from its oxygen; the animal consumes the vegetable thus formed, and in its arteries a reunion of the several elements take place, and produce animal heat. Thus, strictly speaking, the process of building a vegetable is one of winding up; the process of building an animal is one of running down. The warmth of our bodies, and every mechanical energy which we exert, trace their lineage directly to the sun. The fight of a pair of pugilists, the motion of an army, or the lifting of his own body up mountain slopes by an Alpine climber, are all cases of mechanical energy drawn from the sun. Not, therefore, in a poetical, but in a purely mechanical sense, are we children of the sun. Without food, we should soon oxidize our own bodies. A man weighing 150 lbs. has 64 lbs. of muscle; but these, when dried, reduce themselves to 15 lbs. Doing an ordinary day's work, for 80 days, this mass of muscle would be wholly oxidized. Special organs which do more work would be more quickly oxidized: the heart, for example, if entirely unsustained, would be oxidized in about a week. Take the amount of heat due to the direct oxidation of a given amount of food; a less amount of heat is developed by this food in the working animal frame, and the missing quantity is the exact equivalent of the mechanical work which the body accomplishes.

I might extend these considerations; the work, indeed, is done to my hand—but I am warned that I have kept you already too long. To whom, then, are we indebted for the striking generalizations of this evening's discourse? All that I have laid before you is the work of a man of whom you have scarcely ever heard. All that I have brought before you has been taken from the labours of a German physician,

named Mayer. Without external stimulus, and pursuing his profession as town physician in Heilbronn, this man was the first to raise the conception of the interaction of natural forces to clearness in his own mind. And yet he is scarcely ever heard of in scientific lectures, and even to scientific men his merits are but partially known. Led by his own beautiful researches, and quite independent of Mayer, Mr. Joule published his first Paper on the "Mechanical Value of Heat," in 1843; but in 1842 Mayer had actually calculated the mechanical equivalent of heat from data which a man of rare originality alone could turn to account. From the velocity of sound in air, Mayer determined the mechanical equivalent of heat. In 1845 he published his Memoir on "Organic Motion," and applied the mechanical theory of heat, in the most fearless and precise manner, to vital processes. He also embraced the other natural agents in his chain of conservation. In 1853, Mr. Waterston proposed, independently, the meteoric theory of the sun's heat, and in 1854, Professor William Thomson applied his admirable mathematical powers to the development of the theory; but six years previously the subject had been handled in a masterly manner by Mayer, and all that I have said on this subject has been derived from him. When we consider the circumstances of Mayer's life, and the period at which he wrote, we cannot fail to be struck with astonishment at what he has accomplished. Here was a man of genius working in silence, animated solely by a love of his subject, and arriving at the most important results, some time in advance of those whose lives were entirely devoted to natural philosophy. It was the accident of bleeding a feverish patient at Java, in 1840, that led Mayer to speculate on these subjects. He noticed that the venous blood in the tropics was of a much brighter red than in colder latitudes, and his reasoning on this fact led him into the laboratory of natural forces, where he has worked with such signal ability and success. Well, you will desire to know what has become of this man. His mind gave way; he became insane, and he was sent to a lunatic asylum. In a biographical dictionary of his country, it is stated that he died there; but this is incorrect. He recovered; and, I believe, is at this moment a cultivator of vineyards in Heilbronn.

LEGISLATIVE PERFORMANCES OF THE PAST SESSION.

In an article entitled the "Legislative Promises of the Session," published in our Journal for March last, we stated that "seldom has a session of Parliament opened with better prospects of a salutary change being effected in the laws bearing upon commerce than the present." At the close of the session, we are now happy to say that seldom has Parliament more completely realized the hopes which it created at the opening of the session. In the above-named article, we noticed as probable subjects for immediate legislation—first, the simplification of the transference of landed property; secondly, amending the laws relating to trade marks; thirdly, creating copyright in paintings and photographs; and lastly, the establishment of a special tribunal for trying patent cases. So far as respects the transfer of land, public expectation has been met by two enactments, entitled respectively "An Act to

facilitate the Proof of Title to, and the Conveyance of, Real Estate," and "An Act for obtaining a Declaration of Title." As these laws are only permissive, they must be looked upon rather as the beginning of the end than its actual attainment, but they show a great advance in the opinions of landed proprietors, whose influence has hitherto obstructed legislation in this direction.

The last subject on our list has proved too difficult or unripe for prompt action, yet it has not been wholly overlooked, for Sir Hugh Cairns has succeeded in obtaining a Royal Commission "to inquire into the laws relating to Letters Patent for Inventions." This Commission was nominated on the 5th of August last, and includes the following noblemen and gentlemen:—The Right Hon. Edward Henry Smith Stanley (commonly called Lord Stanley); the Right Hon. Lord Overstone; the Right. Hon. Sir William Erle, Knt., Chief Justice of her Majesty's Court of Common Pleas; Sir William Page Wood, Knt., a Vice-Chancellor; Sir William Atherton, Knt., her Majesty's Attorney-General; Sir Hugh McCalmont Cairns, Knt.; Horatio Waddington, Esq.; William Robert Grove, Esq., one of her Majesty's Counsel; William Mathewson Hindmarch, Esq., one of her Majesty's Counsel; William Edward Forster, Esq.; and William Fairbairn, Esq. A better selection than this, we think, under all circumstances, could scarcely be made; for it represents not merely the advocates for patents on principle, and legal men thoroughly acquainted with the administration of the laws, but the opponents of patents are also ably represented. The means is, therefore, provided for a thorough sifting of all the questions bearing on the subject.

With respect to trade marks and artistic copyright, acts have been passed which, we think will, upon the whole, be satisfactory to the interests concerned; and as many of our readers are of that number, abstracts of both the acts are appended. It will be remembered that, when commenting on the bills before Parliament, we took exception to the provision in one enforcing registration, and the want of such a provision in the other. We are happy to be able to state that, in accordance with our views, both bills have received amendment. Trade marks will, therefore, require no registration; but artistic copyrights are made to depend for their existence on registration. The following is an abstract of the new law, which is a masterpiece of verbosity, and is entitled—

The Merchandise Marks Act, 1862.*

2. "Every person who, with intent to defraud, or to enable another to defraud, any person, shall forge or counterfeit, or cause or procure to be forged or counterfeited, any trade mark, or shall apply, or cause or procure to be applied, any trade mark, or any forged or counterfeited trade mark to any chattel or article not being the manufacture, workmanship, production, or merchandise of any person denoted or intended to be denoted by such trade mark, or denoted or intended to be denoted by such forged or counterfeited trade mark, or not being the manufacture, workmanship, production, or merchandise of any person whose trade mark shall be so forged or counterfeited, or shall apply, or cause or procure to be applied, any trade mark, or any forged or counterfeited

* 25 & 26 Vic., cap. 88.

trade mark to any chattel or article, not being the particular or peculiar description of manufacture, workmanship, production, or merchandise denoted or intended to be denoted by such trade mark, or by such forged or counterfeited trade mark, shall be guilty of a misdemeanor. And every person so committing a misdemeanor shall also forfeit to her Majesty, every chattel and article belonging to such person, to which he shall have so unlawfully applied, or caused or procured to be applied, any such trade mark or forged or counterfeited trade mark as aforesaid, and every instrument in the possession or power of such person, and by means of which any such trade mark, or forged or counterfeited trade mark as aforesaid, shall have been so applied, and every instrument in the possession or power of such person for applying any such trade mark or forged or counterfeit trade mark as aforesaid, shall be forfeited to her Majesty; and the court before which any such misdemeanor shall be tried may order such forfeited articles as aforesaid to be destroyed, or otherwise disposed of as such court shall think fit."

Clause 3 makes the application of a forged trade mark to any vessel, case, or wrapper, in or with which any article is intended to be sold, a misdemeanour.

4. "Every person who, after the 31st day of December, 1863, shall sell, utter, or expose, either for sale or for any purpose of trade or manufacture, or cause or procure to be sold, uttered, or exposed for sale or other purpose as aforesaid, any chattel or article, together with any forged or counterfeited trade mark, which he shall know to be forged or counterfeited, or together with the trade mark of any other person applied or used falsely or wrongfully, or without lawful authority or excuse, knowing such trade mark of another person to have been so applied or used as aforesaid, and that whether any such trade mark or forged or counterfeited trade mark as aforesaid, together with which any such chattel or article shall be sold, uttered, or exposed for sale or other purpose as aforesaid, shall be in, upon, about, or with such chattel or article, or in, upon, about, or with any cask, bottle, stopper, vessel, case, cover, wrapper, band, reel, ticket, label, or other thing in, upon, about, or with which such chattel or article shall be so sold or uttered, or exposed for sale or other purpose as aforesaid, shall for every such offence forfeit and pay to her Majesty, a sum of money equal to the value of the chattel or article so sold, uttered, offered, or exposed for sale or other purpose as aforesaid, and a further sum not exceeding five pounds, and not less than ten shillings."

Clause 5 enacts, that additions to, and alterations of, trade marks, made with intent to defraud, are forgeries.

6. "Where any person who, at any time after the 31st day of December, 1863, shall have sold, uttered, or exposed for sale or other purpose as aforesaid, or shall have caused or procured to be sold, uttered, or exposed for sale or other purpose as aforesaid, any chattel or article, together with any forged or counterfeited trade mark, or together with the trade mark of any other person used without lawful authority or excuse as aforesaid, and that whether any such trade mark, or such forged or counterfeited trade mark as aforesaid, be in, upon,

about, or with such chattel or article, or in, upon, about, or with any cask, bottle, stopper, vessel, case, cover, wrapper, band, reel, ticket, label, or other thing, in, upon, about, or with such chattel or article shall have been sold or exposed for sale, such person shall be bound, upon demand in writing, delivered to him or left for him at his last known dwelling house, or at the place of sale or exposure for sale, by or on the behalf of any person whose trade mark shall have been so forged or counterfeited, or used without lawful authority or excuse as aforesaid, to give to the person requiring the same, or his attorney or agent, within forty-eight hours after such demand, full information in writing of the name and address of the person from whom he shall have purchased or obtained such chattel or article, and of the time when he obtained the same; and it shall be lawful for any Justice of the Peace, on information on oath of such demand and refusal, to summon before him the party refusing, and on being satisfied that such demand ought to be complied with, to order such information to be given within a certain time to be appointed by him; and any such party who shall refuse or neglect to comply with such order, shall, for every such offence, forfeit and pay to her Majesty the sum of five pounds, and such refusal or neglect shall be *primâ facie* evidence that the person so refusing or neglecting had full knowledge that the trade mark, together with which such chattel or article was sold, uttered, or exposed for sale or other purpose as aforesaid, at the time of such selling, uttering, or exposing, was a forged, counterfeited, and false trade mark, or was the trade mark of a person which had been used without lawful authority or excuse, as the case may be.

7. "Every person who, with intent to defraud or to enable another to defraud, shall put, or cause or procure to be put, upon any chattel or article, or upon any cask, bottle, stopper, vessel, case, cover, wrapper, band, reel, ticket, label, or other thing, together with which any chattel or article shall be intended to be or shall be sold or uttered or exposed for sale, or for any purpose of trade or manufacture, or upon any case, frame, or other thing, in or by means of which any chattel or article shall be intended to be or shall be exposed for sale, any false description, statement, or other indication of or respecting the number, quantity, measure, or weight of such chattel or article, or any part thereof, or of the place or country in which such chattel or article shall have been made, manufactured, or produced, or shall put, or cause or procure to be put, upon any such chattel or article, cask, bottle, stopper, vessel, case, cover, wrapper, band, reel, ticket, label, or thing, as aforesaid, any word, letter, figure, signature, or mark, for the purpose of falsely indicating such chattel or article, or the mode of manufacturing or producing the same, or the ornamentation, shape, or configuration thereof, to be the subject of any existing patent, privilege, or copyright, shall, for every such offence, forfeit and pay to her Majesty a sum of money equal to the value of the chattel or article so sold or uttered or exposed for sale, and a further sum not exceeding five pounds, and not less than ten shillings."

By clause 8, persons selling, or exposing for sale, after December 31st, 1863, articles with a false statement of quantities, will incur a penalty of from 5*s.* to £5; but names or words commonly used to indicate par-

ticular classes of manufactures, although not strictly correct in their original application, will not be open to objection. Clauses 10, 11, and 12, point out the mode of proceeding to convict offenders under the act.

13. "Every person who shall aid, abet, counsel, or procure the commission of any offence, which is by this Act made a misdemeanor, shall also be guilty of a misdemeanor.

14. "Every person who shall be convicted or found guilty of any offence, which is by this Act made a misdemeanor, shall be liable at the discretion of the court, and as the court shall award, to suffer such punishment by imprisonment for not more than two years, with or without hard labour, or by fine, or both by imprisonment, with or without hard labour, and fine, and also by imprisonment until the fine (if any) shall have been paid and satisfied."

Clauses 15, 16, and 17 relate to recovering penalties.

18. "No person shall commence any action or proceeding for the recovery of any penalty, or procuring the conviction of any offender in manner hereinbefore provided, after the expiration of three years next after the committing of the offence, or one year next after the first discovery thereof by the person proceeding.

19. "In every case, in which, at any time, after the 31st of December, 1863, any person shall sell, or contract to sell, whether by writing or not, to any other person, any chattel or article, with any trade mark thereon, or upon any cask, bottle, stopper, vessel, case, cover, wrapper, band, reel, ticket, label, or other thing, together with such chattel or article, shall be sold, or contracted to be sold, the sale or contract to sell shall, in every such case, be deemed to have been made with a warranty or contract by the vendor to or with the vendee, that every trade mark upon such chattel or article, or upon any such cask, bottle, stopper, vessel, case, cover, wrapper, band, reel, ticket, label, or other thing as aforesaid, was genuine and true, and not forged or counterfeit, and not wrongfully used, unless the contrary shall be expressed in some writing signed by, or on behalf of, the vendor, and delivered to, and accepted by, the vendee."

The above provision, relating to genuineness, is extended by clause 20 to the statement of the number, quantity, measure, or weight, upon the bottle, case, or reel containing the vendable article; and the six remaining clauses provide for the awarding of injunctions, the recovery of damages, the indemnifying of successful defendants of suits, &c. Upon a careful consideration of the act, we think it will fully meet the requirements of manufacturers, traders, and the public generally, and that it will induce—by stigmatizing the forgery of trade brands as a misdemeanor, which is punishable by imprisonment—a more healthy tone in the trading community.

The act for amending the law relating to copyright in works of the fine arts, is closely allied to the above-mentioned act, as it aims, as expressed in the title of the act, at "repressing the commission of fraud in the production and sale of such works." The "works of the fine arts," included

under this act, are paintings, drawings, and photographs; sculpture, models, and casts, which were originally intended, by the bill prepared under the auspices of the Society of Arts, to be provided for, being left to the protection of the old law, which has been found unequal to its requirements. We have said that registration is made an essential in securing copyright, but the provision for obtaining a legal title is pushed to what we think an unreasonable extent. Very properly, the mere exhibition of a picture before registration, does not destroy copyright in the work—the artist holding, like the author, all rights over his work, so long as it is not disposed of; but although copyright passes with the sale of the work—unless that right is reserved by an express agreement in writing—yet, singularly enough, and for no very obvious reason, the purchaser of the painting or drawing does not acquire with it a copyright, "unless, *at or before the time of such sale* or disposition, an agreement, in writing, signed by the person so selling or disposing of the same, shall have been made to that effect." The failure, then, on the part of the seller or purchaser to reduce their transaction, in its full terms, to writing, will irrecoverably avoid the copyright. The following is an abstract of

The Fine Arts Copyright Act.*

1. "The author, being a British subject, or resident within the dominions of the crown, of every original painting, drawing, and photograph, which shall be, or shall have been, made, either in the British dominions or elsewhere, and which shall not have been sold or disposed of before the commencement of this Act, and his assigns, shall have the sole and exclusive right of copying, engraving, reproducing, and multiplying such painting or drawing, and the design thereof, or such photograph and the negative thereof, by any means and of any size, for the term of the natural life of such author, and seven years after his death. Provided, that when any painting or drawing, or the negative of any photograph, shall for the first time, after the passing of this Act, be sold or disposed of, or shall be made or executed for, or on behalf of, any other person, for a good or a valuable consideration, the person so selling or disposing of, or making or executing the same, shall not retain the copyright thereof, unless it be expressly reserved to him by agreement, in writing, signed, at or before the time of such sale or disposition, by the vendee or assignee of such painting or drawing, or of such negative of a photograph, or by the person for or on whose behalf the same shall be so made or executed, but the copyright shall belong to the vendee or assignee of such painting or drawing, or of such negative of a photograph, or to the person for or on whose behalf the same shall have been made or executed; nor shall the vendee or assignee thereof be entitled to any such copyright, unless, at or before the time of such sale or disposition, an agreement, in writing, signed by the person so selling or disposing of the same, or by his agent, duly authorized, shall have been made to that effect.

2. "Nothing herein contained shall prejudice the right of any person to copy or use any work in which there shall be no copyright or to

* 25 & 26 Vic., cap. 68.

represent any scene or object, notwithstanding that there may be copyright in some representation of such scene or object.

3. "All copyright under this Act shall be deemed personal or moveable estate, and shall be assignable at law, and every assignment thereof, and every license to use or copy, by any means or process, the design or work which shall be the subject of such copyright, shall be made by some note or memorandum in writing, to be signed by the proprietor of the copyright, or by his agent, appointed for that purpose, in writing.

4. "There shall be kept at the Hall of the Stationers' Company, by the officer appointed by the said Company, for the purposes of the Act passed in the sixth year of her present Majesty, intituled *An Act to amend the Law of Copyright*, a book or books, entitled 'The Register of Proprietors of Copyright in Paintings, Drawings, and Photographs,' wherein shall be entered a memorandum of every copyright to which any person shall be entitled under this Act, and also of every subsequent assignment of any such copyright; and such memorandum shall contain a statement of the date of such agreement or assignment, and of the names of the parties thereto, and of the name and place of abode of the person in whom such copyright shall be vested by virtue thereof, and of the name and place of abode of the author of the work in which there shall be such copyright, together with a short description of the nature and subject of such work, and in addition thereto, if the person registering shall so desire, a sketch, outline, or photograph of the said work; and no proprietor of any such copyright shall be entitled to the benefit of this act until such registration, and no action shall be sustainable, nor any penalty be recoverable, in respect of anything done before registration."

Clause 5 relates to the mode of keeping the registry book and making extracts therefrom and alterations therein.

6. "If the author of any painting, drawing, or photograph, in which there shall be subsisting copyright, after having sold or disposed of such copyright, or if any other person, not being the proprietor for the time being of copyright in any painting, drawing, or photograph, shall, without the consent of such proprietor, repeat, copy, colorably imitate, or otherwise multiply for sale, hire, exhibition, or distribution, or cause or procure to be repeated, copied, colorably imitated, or otherwise multiplied for sale, hire, exhibition, or distribution, any such work or the design thereof, or, knowing that any such repetition, copy, or other imitation has been unlawfully made, shall import into any part of the United Kingdom, or sell, publish, let to hire, exhibit, or distribute, or offer for sale, hire, exhibition, or cause or procure to be imported, sold, published, let to hire, distributed, or offered for sale, hire, exhibition, or distribution, any repetition, copy, or imitation of the said work, or of the design thereof, made without such consent as aforesaid, such person, for every such offence, shall forfeit to the proprietor of the copyright for the time being a sum not exceeding £10; and all such repetitions, copies, and imitations, made without such consent as aforesaid, and all negatives of photographs made for the purpose of obtaining such copies, shall be forfeited to the proprietor of the copyright.

7. "No person shall do, or cause to be done, any or either of the following acts; that is to say:—

First.—No person shall fraudulently sign or otherwise affix, or fraudulently cause to be signed or otherwise affixed, to or upon any painting, drawing, or photograph, or the negative thereof, any name, initials, or monogram.

Secondly.—No person shall fraudulently sell, publish, exhibit, or dispose of, or offer for sale, exhibition, or distribution, any painting, drawing, or photograph, or negative of a photograph, having thereon the name, initials, or monogram of a person who did not execute or make such work.

Thirdly.—No person shall fraudulently utter, dispose of, or put off, or cause to be uttered or disposed of, any copy or colorable imitation of any painting, drawing, or photograph, or negative of a photograph, whether there shall be subsisting copyright therein or not, as having been made or executed by the author or maker of the original work, from which such copy or imitation shall have been taken.

Fourthly.—Where the author or maker of any painting, drawing, or photograph, or negative of a photograph, made either before or after the passing of this Act, shall have sold or otherwise parted with the possession of such work, if any alteration shall afterwards be made therein by any other person, by addition or otherwise, no person shall be at liberty, during the life of the author or maker of such work, without his consent, to make, or knowingly to sell or publish, or offer for sale, such work, or any copies of such work, so altered as aforesaid, or of any part thereof, as or for the unaltered work of such author or maker.

Every offender under this section shall, upon conviction, forfeit to the person aggrieved a sum not exceeding £10, or not exceeding double the full price, if any, at which all such copies, engravings, imitations, or altered works, shall have been sold or offered for sale; and all such copies, engravings, imitations, or altered works, shall be forfeited to the person, or the assigns or legal representatives of the person, whose name, initials, or monogram shall be so fraudulently signed or affixed thereto, or to whom such spurious or altered work shall be so fraudulently or falsely ascribed as aforesaid. Provided always, that the penalties imposed by this section shall not be incurred, unless the person whose name, initials, or monogram shall be so fraudulently signed or affixed, or to whom such spurious or altered work shall be so fraudulently or falsely ascribed as aforesaid, shall have been living at or within twenty years next before the time when the offence may have been committed."

The character of the proceedings for recovering pecuniary penalties from infringers of copyright is set forth in clauses 8 and 9.

10. "All repetitions, copies, or imitations of paintings, drawings, or photographs, wherein, or in the design whereof, there shall be subsisting copyright under this Act, and all repetitions, copies, and imitations, of the design of any such painting or drawing, or of the negative of any

such photograph, which, contrary to the provisions of this Act, shall have been måde in any foreign state, or in any part of the British dominions, are hereby absolutely prohibited to be imported into any part of the United Kingdom, except by, or with the consent of, the proprietor of the copyright thereof, or his agent, authorised in writing; and if the proprietor of any such copyright, or his agent, shall declare that any goods imported are repetitions, copies, or imitations of any such painting, drawing, or photograph, or of the negative of any such photograph, and so prohibited as aforesaid, then such goods may be detained by the officers of her majesty's customs."

The two remaining clauses relate, respectively, to the saving of the right to bring an action for damages, and to the admission of foreign nations to the benefits of this Act, under the international copyright arrangement, which is slowly extending its benefits over Europe, but as yet has been stoutly resisted in the United States. Although we could have wished that this law had taken a wider range, we must still deem it a great acquisition; as it will bring artists and patrons to a proper understanding of their respective rights, it will crush the mercenary trafficers on the reputations of eminent artists, and will afford such protection to photographers as may induce them to travel through unknown regions for the purpose of bringing to a profitable market the results of their artistic labours.

Provisional Protections Granted.

1862.

[*Cases in which a Full Specification has been deposited.*]

2052. Oscar Fitzalan Morrill, of Massachusetts, U.S.A., for a certain new and useful apparatus for generating heat for culinary or various other purposes.—[*Dated July* 18*th.*]

2144. Rosewell Thompson, of Boston, U.S.A., for a new and useful improvement in lock-stitch sewing machines.—[*Dated July* 29*th.*]

2161. Horatio White, of Hampstead-road, for improvements in shirt collars.—[*Dated July* 30*th.*]

[*Cases in which a Provisional Specification has been deposited.*]

845. Jean David Schneiter, of Paris, for an improved method for printing letters, numbers, musical, or other characters or signs on maps, plans, sheets of music, paper, or other similar impressions.—[*Dated March* 27*th.*]

1023. William Nunn, of Saint George-street, for improvements in the construction of lanterns for ships and signals.—[*Dated April* 10*th.*]

1043. William Edward Gedge, of Wellington-street, Strand, for an improved lamp for lighting mines,—being a communication.—[*Dated April* 11*th.*]

1096. Thomas Edwards and Joseph Harrison, both of Liverpool, for improvements in letter receiving boxes, and other like receptacles.—[*Dated April* 16*th.*]

1155. Samuel Parkes Mathews, of Wolverhampton, for improvements in vices.—[*Dated April* 21*st.*]

1212. John Taylor Davies, of Liverpool, for improvements in circuit horse powers,—being a communication.—[*Dated April* 25*th.*]

1226. Thomas Unett Brocklehurst, of Macclesfield, for improvements in machinery for reeling singles, trams, organzines, and sewing silks.—[*Dated April* 26*th.*]

1300. Charles Frederick Whitworth,

of Sowerby Bridge, Yorkshire, for improvements in apparatuses for signalling upon railways.—[*Dated May 2nd.*]

1307. Henri Juhel, of Bordeaux, for an improvement in wheels,—being a communication.

1316. George Neall, of Islington, for improved apparatus for obtaining and applying motive power, especially applicable to propelling carriages on common roads.

The above bear date May 3rd.

1377. Andrew Bearne, of Torquay, for improvements in the construction of boots, shoes, and goloshes, rendering them elastic to pressure.—[*Dated May 8th.*]

1517. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improved machinery for splitting leather,—being a communication.—[*Dated May 19th.*]

1526. Maurice Vogl, of Sambrook-court, for improved apparatus for protecting houses and other buildings from burglars.—[*Dated May 20th.*]

1530. John Hopkinson, of Regent-street, for improvements in pianofortes and in the hammer rails of pianofortes.—[*Dated May 21st.*]

1676. John Fincham, of Mildenhall, Suffolk, for an arrangement or arrangements of mechanism useful for facilitating the repairing of roads and ways, also applicable to the tilling of land.—[*Dated June 3rd.*]

1767. James Lancelott, of Birmingham, for improvements in the manufacture of ornamental chains from sheet metal.

1771. Jean Felix Miquel, of Tours, France, for an improved pessary.

The above bear date June 14th.

1797. James Wheater and John Townend, both of Bacup, Lancashire, for improvements in self-acting and other mules for spinning cotton or any other fibrous substances.—[*Dated June 18th.*]

1827. Bernardo Fabbricotti, of Leadenhall-street, for a polishing and grinding belt, formed of leather or other flexible or pliable material, having plugs composed of emery or other gritty substance, and a proper cement inserted in it substantially,—being a communication.

1836. Antoine Frédéric Maigron, of Marseilles, for improvements in machinery or apparatus for the manufacture of tow or oakum, and for winding off, carding, and spinning all kinds of fibrous fabrics.

The above bear date June 21st.

1855. James Johnston, of Paisley, for improvements in hats.—[*Dated June 24th.*]

1868. John Whitham, of Leeds, for improvements in the apparatus used in working oil and other hydraulic presses.—[*Dated June 25th.*]

1873. Edward Thomas Hughes, of Chancery-lane, for improvements in regulating or moderating the movement of the keys of piano-fortes,—being a communication.—[*Dated June 26th.*]

1892. Daniel Lancaster Banks, of Gracechurch-street, for a new method of constructing a portable covered cofferdam or apparatus for facilitating operations under the water, in the water, or out of the water, and apparatus connected therewith.

1893. Daniel Lancaster Banks, of Gracechurch-street, for a method of constructing a portable sectional dry dock, and apparatus connected therewith.

The above bear date June 27th.

1895. Thomas King, of Grafton, Warwickshire, and John King, of Chadshunt, Warwickshire, for improvements in agricultural machines.

1896. Charles Beslay, of Paris, for improvements in galvanizing or coating metals by electro-chemical agency, and in apparatus connected therewith.

1897. George Henry Hulskamp, of New York, U.S.A, for improvements in pianofortes.

1898. John Garnier, of Devonport, for improvements in ordnance and in projectiles.

1899. George Washington Belding, of King-street, Cheapside, for an improved flexible-spring cloth or fabric, especially adapted for the manufacture of ladies' skirts.

1900. Charles Callebaut, of Paris,

for certain improvements in sewing machines.

1901. John Tatham, of Rochdale, for improvements in machinery or apparatus for preparing, spinning, doubling, and winding cotton, wool, and other fibrous materials.

1903. John Webster, of Ipswich, for improvements in the means of protecting steam boilers from incrustation.

1904. Nathan Thompson, of Abbey-gardens, St. John's Wood, for improvements in apparatus for stopping bottles, jars, and other vessels, and in instruments for applying and removing such stopping apparatus.

The above bear date June 28th.

1905. Joseph Wall and Thomas Dodd, both of Liverpool, for improvements in taps for controlling the flow or passage of fluids.

1906. William Thomas, of Liverpool, for improvements in the running gear of four-wheeled carriages.

1907. James Hartshorn, of Nottingham, for improvements in the manufacture of lace.

1908. Aungeir Byrnes, of Metropolitan-buildings, Mile-end, for improvements in breech-loading fire-arms.

1909. William Edward Gedge, of Wellington-street, Strand, for improvements in looms for weaving,—being a communication.

1910. William Fullarton Murray, of Glasgow, for improvements in the manufacture of stoneware bottles, and in apparatus connected therewith.

1911. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improved apparatus for picking or gathering cotton,—being a communication.

1912. William Easton and George Donkin, both of Gateshead-on-Tyne, for improvements in lears or annealing chambers, and apparatus used in annealing glass.

1913. Thomas Parker, of Leeds, for improvements in tinting or dyeing fabrics composed of mixed animal and vegetable fibres.

The above bear date June 30th.

1914. John Parkinson, of Bury, and John Marsland, of Newchurch, for improvements in apparatus for regulating the flow and pressure of steam and other fluids.

1915. Elijah Freeman Prentiss, of Birkenhead, for improvements in the construction of omnibusses and other four-wheeled vehicles.

1916. Edmond Pourpoint, of Paris, for an improved wool washing machine.

1917. Richard Archibald Brooman, of Fleet-street, for improvements in the construction of blast furnaces,—being a communication.

1918. Charles Lungley, of Deptford, for improvements in constructing, building, and working floating docks and other floating bodies, and in pumping apparatus to be employed therein.

1919. George Henry Birkbeck, of Southampton-buildings, for improvements in processes for the utilization of certain refuse products resulting from the manufacture of iron; such processes being applicable to the treatment of other metallic or mineral substances,—being a communication.

1920. Jesse Greenhalgh, of Hyde, and James Greenhalgh, of Audenshaw, both in Lancashire, for an improved diminishing valve, and also a water or steam escape apparatus, to give alarm in case of fire, and to assist in quenching the same.

1921. Thomas Fellowes and Henry Hemfrey, both of Spalding, for improvements in apparatus for elevating straw and other agricultural produce.

1922. John Macmillan Dunlop, of Manchester, for improvements in cotton gins.

1923. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improved machinery for washing wool,—being a communication.

The above bear date July 1st.

1924. Eugéne de Labastida, of Hart-street, Bloomsbury-square, for a new method of manufacturing india-rubber articles by the simultaneous combination of pressure and vulcanization,—being a communication.

1925. William Porter, of Fleetwood, Lancashire, for improvements in the manufacture of targets.

1926. John James, of Newport, Monmouthshire, for an improved mode of welding railway crossings.
1927. Joseph Ellerbeck, of Heywood, Lancashire, for improvements in looms for weaving.
1928. Bryan Johnson, of Chester, for improvements in rope wheels for mines, collieries, and other similar purposes.
1929. Thomas Lamb Atkinson, of Stamford-street, Blackfriars-road, for improvements in the construction of stew pans and other such like cooking utensils.
1930. George Henry Hulskamp, of Troy, New York, for improvements in violins and other similar stringed instruments, and in guitars.
1931. John Murray, of Whitehall-place, for improvements in portmanteaus.
1932. John Steel, of Stirling, N.B., for improvements in waterclosets.
1933. Joseph Crisp and Joseph William Elliott, both of South Shields, for improvements in apparatus for burning American rock oil, paraffine oil, oil of petroleum, and other inflammable oils, spirits, or essences.
1934. James Webster, of Birmingham, for improved apparatus for the manufacture of gas for illumination.
1935. George Bedson, of Manchester, for improvements in rolling wire and other rods or bars of metal.
1936. John Muir Hetherington, of Manchester, and Thomas Jackson, of Stockport, for improvements in machinery or apparatus for preparing, spinning, and doubling cotton and other fibrous materials.

The above bear date July 2nd.

1937. Thomas Turner, of Birmingham, and William Taylor, of Aston New Town, for certain improvements in single and double breech-loading fire-arms.
1938. George Henry Birkbeck, of Southampton-buildings, for improvements in the construction of mechanical horses,—being a communication.
1939. William Armand Gilbee, of South-street, for an improved manufacture of blue coloring matter,—being a communication.
1940. William Mattieu Williams, of Handsworth, for improvements in apparatus for the distillation of coal and peat, and such other substances as are or may be used for the manufacture of solid and liquid volatile hydro-carbons.
1941. Thomas Edmunds, of Seymour-place, Bryanstone-square, for improvements in preparing compressed fruits in cakes.
1942. Thomas Ogden Dixon, of Steeton, Yorkshire, for improvements in means or apparatus for heating or warming rooms or buildings with steam, and in carrying off the condensed steam or water therefrom.
1943. James Miles, of Street, near Glastonbury, for improvements in machinery for cutting out soles and other parts used in the manufacture of boots and shoes, and also parts used in the manufacture of other articles.

The above bear date July 3rd.

1944. Samuel Russell, of Shaftesbury-crescent, Pimlico, for improvements in stereoscopes.
1945. William John Cunningham, of Everett-terrace, Victoria Dock-road, for improvements in sewing machines.
1946. Adolphe Drevelle, of Manchester, for improvements in machinery or apparatus for laying cards or sheets of metal into woven or textile fabrics ready for the press, and also for folding, measuring, or stretching the said fabrics, paper, and other materials.
1947. Samuel Whitham, of Wakefield, Yorkshire, for improvements in the manufacture of iron and steel, and in the apparatus employed for that purpose,—being a communication.
1948. John Howard and John Bullough, both of Accrington, for improvements in warping and beaming machines.

The above bear date July 4th.

1949. Henry Rushton, of Northampton-road, Clerkenwell, for improvements in covering crinoline steels.
1950. Richard Archibald Brooman, of Fleet-street, for improvements in

hollow plates for hydraulic presses,—being a communication.

1951. Oscar Fredrik Byström, of Stockholm, for an improved pyrometer.

1952. Charles Grey Hill and William Jackson, both of Nottingham, for improvements in machinery or apparatus for producing ornamental patterns or figures, and attaching them to lace or other fabrics.

1953. Arthur Warner, of Threadneedle-street, for improvements in preparing materials for and in purifying coal gas.

1954. Patrick Benignus O'Neill, of Warwick-street, Regent-street, for improvements in screw wrenches or spanners.

The above bear date July 5th.

1955. Joshua Kidd, of Cannon-row, Westminster, for improvements in gas meters.

1956. Charles Wessely, of Canterbury-place, Lambeth-road, for improvements in carriages.

1957. Thomas Edwards, of Liverpool, for improved movement for the indices for gas, water, and other fluid meters.

1959. John Peter Booth, of Cork, Ireland, for improvements in the manufacture of feather beds, quilts, bolsters, and pillows.

The above bear date July 7th.

1960. William Spence, of Chancery-lane, for improvements in telegraphic apparatus,—being a communication.

1961. John Henry Johnson, of Lincoln's-inn-fields, for improvements in wet gas meters,—being a communication.

1962. Carl Bernhard Gruner, of Frauenfeld, Switzerland, for improvements in photographic apparatus.

1963. John Brown, of Middleton, Lancashire, for an improved motion for actuating the doffers of carding engines for carding cotton and other fibrous substances.

1965. Charles Slatford, of Cannon-street West, for improvements in trimmings, tufts, and other articles for ornamental and decorative purposes.

1966. John Rigby, of Dublin, for improvements in breech-loading guns, and in extracting cartridges from such guns, and also in wind sights for fire-arms.

1968. Joseph Bourke, of Curragh-leagh, Ireland, for improvements in military accoutrements.

1969. Henry Wethered, of Bristol, for improvements in the construction of handles, latches, or fastenings for doors, gates, and windows.

The above bear date July 8th.

1970. William Lawrence Wigginton, of Clifton-cottages, Hammersmith, for an improved method of, and apparatus for, curing smoky chimneys.

1972. Thomas Cummings Gibson, of Ramsey, Isle of Man, for improvements in the construction of ships and vessels for the purpose of carrying and warehouseing petroleum, palm oil, and other oils or inflamable fluids.

1973. Alfred Gilbey, of Oxford-street, for improvements in apparatus for washing and cleansing bottles.

1974. Henry Saltmarsh Pontifex, of Banbury, for improvements in apparatus for distributing water, applicable to cleansing casks or other vessels, or for other purposes.

1975. Joseph Rhodes, of Morley, near Leeds, for improvements in rag machines,—being a communication.

1976. Charles Frederick William Rust, of London-wall, for improvements in concertinas and other wind instruments of that class,—being a communication.

1977. Hermann Eschwege, of Mincing-lane, for improvements in purifying wood and other vinegar.

1978. George Tomlinson Bousfield, of Loughborough-park, Brixton, for improvements in washing machines,—being a communication.

1979. Edmund Samuel Hindley, of Bourton, Dorsetshire, for improvements in apparatus used when circulating hot water for warming dwelling houses and other places; which apparatus may be used for cooling and condensing.

1980. Thomas Green, of Leeds, and Robert Mathers, of Victoria-street, for improvements in steam boilers.

1981. Sven Victor Evers, of Lower Thames-street, for improvements in

the preparation of beverages,—being partly a communication.

1982. John Octavius Butler, of the Kirkstall Forge Company, near Leeds, for improvements in steam hammers, and in framings therefor.

The above bear date July 9th.

1983. William Francis Reynolds, of the Commercial-road, for an improved watch-pendant.

1984. Emile Jaudeau, of Brighton, for an improved method of, and apparatus for, removing the bad flavour from alcohols distilled from grain, beetroot, or other vegetables; and for extracting the whole of the alcohol contained in the fermented juice.

1985. Henry Kellogg, of New Haven, U.S.A., for improvements in breech-loading fire-arms and cartridges therefor.

1986. Joseph Mander, of Birmingham, for improvements in crochet needles and crochet needle holders.

1987. Ann Bonnell, of Maida-hill, for improvements in churns,—being a communication.

1988. Joseph Ponti, of Venice, for an improved apparatus for viewing photographic pictures, and the preparation of photographic pictures to be used in such apparatus,—being a communication.

1989. Edward John Biddle, of New York, for the use of petroleum or coal oil as fuel, and also for the machinery and apparatus to be employed for this purpose.

1991. John Leeming, of Bradford, Yorkshire, for improvements in jacquard or index machines.

1992. Daniel Steele, of Bunhill-row, for improvements in the method of flushing or distributing the water in pans or basins; applicable to water closets, urinals, washhand basins, or other purposes.

1993. Thomas Farra, of Manchester, for improvements in wearing apparel called skirts or petticoats and frocks.

1994. John Henry Johnson, of Lincoln's-inn-fields, for improvements in braiding machines,—being a communication.

The above bear date July 10th.

1995. John Reed Hill, of Duke-street, Adelphi, for an improved governor for the engines of steam vessels.

1996. Matthew Cornall and Evan Griffiths, both of Manchester, for improvements in doubling, twisting, and reeling threads and yarns of cotton and other fibrous materials.

1997. Joseph Waithman, of Manchester, for improvements in machinery or apparatus for carding flax, tow, or other fibrous materials.

1999. John Orr, of Glasgow, for improvements in weaving piled fabrics, and in the machinery or apparatus connected therewith.

2000. James Miller, of Lambeth, for improvements in apparatus for steering ships and other vessels.

2001. William Bliss, of Chipping Norton, for improvements in heating ores, and in generating steam; and also in the apparatus employed therein,—being a communication.

The above bear date July 11th.

2002. Charles Edmond Green, of Blandford-street, Portman-square, and John Green of Edmonton, for improvements in breech-loading firearms.

2003. John Pipler Lees and John Beard, both of Ashton-under-Lyne, for certain improvements in carding engines.

2004. John Abraham, of Birmingham, for improvements in presses for raising or shaping metals.

2005. Jacob Hunt, of Preston, Lancashire, for improvements in the process of sizing and drying yarns or threads, and in the apparatus employed in such process.

2007. Thomas Hill, of Great Warley, Essex, for improvements in the arrangements employed for the protection of markers at rifle butts, and in the means employed in indicating the score and position of the shot, and wiping out the shot mark.

2008. Edward Thomas Hughes, of Chancery-lane, for an improved system of winding or rolling silk thread on moulds or bobbins, and placing them in suitable boxes,—being a communication.

2009. John Henry Johnson, of Lincoln's-inn-fields, for improvements in machinery or apparatus for wash-

ing ores and minerals, — being a communication.

2010. William Edward Gedge, of Wellington-street, Strand, for improvements in the manufacture of hats,—being a communication.

2011. Pierre Plassan, of Tours, France, for an improved orthopœdic apparatus for straightening the human frame.

2013. Henry Barber and Henry De Garrs, both of Sheffield, for improvements in rolling iron, steel, and other metals, for cutlery, tools, and other purposes.

2014. The Honourable William Erskine Cochrane, of Osnaburgh-terrace, Regent's-park, for improvements in railway fastenings.

The above bear date July 12*th*.

2015. Eliza Taylor, of Regent-street, for improvements in the manufacture of buttons.

2016. George Lowry, of Salford, for improvements in machinery for carding and cleaning cotton and other fibrous materials.

2017. William Edward Gedge, of Wellington-street, Strand, for an improved portable or stationary steam lift and force pump,—being a communication.

2018. Adolphe Antoine Gannal, of Paris, for certain improvements in the manufacture of bituminous cement.

2019. Charles Crossley and James William Crossley, both of Halifax, for improvements in means or apparatus employed in washing and finishing textile fabrics.

2020. Samuel Partridge, of Darlaston, for improvements in railway signals.

2021. Peter Sanderson and Robert Sanderson, both of Galashiels, N.B., for improvements in the manufacture of woven fabrics, and in the machinery or apparatus employed therein.

2022. William Gladstone May, of Glasgow, for improvements in apparatus for extending tables.

2023. Paul Antoine Lucien Canonicat, of Marseilles, for improvements in filtering water, and in apparatus employed therein.

2024. George Fawcus, of North Shields, for improvements in building boats.

2025. Frederick Major Parkes, of Plumstead, for improvements in the manufacture of gas for lighting and heating, and in apparatus employed in the said manufacture.

2027. Robert Ridley, of Morlui, near Leeds, and James Grafton Jones, of Battersea, for improvements in machinery and apparatus for ventilating mines and other places.

The above bear date July 14*th*.

2028. Alexander Leslie, of Turriff, Aberdeenshire, N.B., for improvements in apparatus for applying steam or other motive power to cultivate the soil and to actuate wheeled carriages.

2030. John Green, of Newtown, Worcestershire, for improvements in the method and means of producing signals, and in the application of the same particularly to steam ploughs or cultivators.

2033. William Dickens, of Salford, and John Hewitt, of Manchester, for improvements in self-acting and hand mules employed in spinning cotton and other fibrous materials.

2034. Charles Edward Crawley, of Gracechurch-street, and Frederick Foster, of Ashley-crescent, City-road, for improvements in safety or miners' lamps.

The above bear date July 15*th*.

2036. Bryan Johnson, of Chester, and Edward Henry Taylor, of Coed Talon, near Mold, Flintshire, for improvements in rope wheels, cages, and tanks, used for mines, collieries, and other similar purposes.

2037. George Thomas Selby, of Smethwick, Staffordshire, for improvements in apparatus for superheating in tubes and tubular articles, and in machinery for the manufacture thereof.

2038. Louis Rudolph Bodmer, of Thavies-inn, for improvements in apparatus for winding up watches and other time-keepers,—being a communication.

2039. William Henson, of Nottingham, and William Williams Clay, of Sneinton, Nottinghamshire, for improvements in knitting machinery,

and in apparatus connected therewith.

2040. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for an improvement in sewing machines,—being a communication.

2041. Charles Sanderson, of Sheffield, for improvements in the manufacture of crinoline or crinoline steel.

2042. Robert Dunn, of Newcastle-upon-Tyne, for improvements in furnaces for steam boilers and other purposes.

The above bear date July 16*th.*

2043. Manilias Kurts, of Bishopsgate-street Without, for a new or improved material to be used in the manufacture of handles for umbrellas, parasols, and walking sticks.

2044. James Dickson, of Tollington-road, Holloway, for improvements in the manufacture of caustic soda and carbonate of soda.

2045. Henry Appleby, of Plumstead, for improvements in armour plates for ships of war, floating and land batteries, and other like purposes.

2046. John Gillison Harkness, of Birkenhead, for an improved safety handle for winches, cranes, and other like machines.

2047. Joseph Schloss, of Cannon-street, for improvements in pouches.

2048. Thomas Barnabas Daft, of Queen-square, Westminster, for improvements in the manufacture of mats and other surfaces where vulcanized india-rubber is employed.

2049. Thomas Barnabas Daft, of Queen-square, Westminster, for improvements in the manufacture of vulcanized india-rubber thread.

The above bear date July 17*th.*

2050. William Gossage, of Widnes, Lancashire, for an improved method of, and apparatus for, decomposing chloride of sodium and chloride of potassium, for the production of compounds of soda and potassa.

2054. Joseph Richard Abbott, of Birmingham, for improvements in sliding chandeliers, gasaliers, and other pendent lamps.

2055. John Stephen Jarvis, of Wood-street, for improvements in shirt collars.

2057. Charles Arthur Day and Thomas Summers, both of Northam Iron Works, Southampton, for improvements in sheer legs.

The above bear date July 18*th.*

2058. Andrew Betts Brown, of Stockport, for improvements in steam engines and boilers.

2059. George John Yates and John William Ward Tindall, both of Liverpool, for a process of deodorizing paraffin, coal, pitch, rock, and other like oils and hydro-carbons.

2060. Robert Barrett, of Stepney, for improvements in apparatus for working the damper of steam engine furnaces.

2061. Richard Archibald Brooman, of Fleet-street, for improvements in revivifying animal black, in apparatus employed therein, and in recovering a product employed in the revivification,—being a communication.

2062. Alphonse Cotelle, of Saint Quentin, France, for improvements in the manufacture of alcohol.

2063. Alfred Pratt, of Devonshire-place, Wandsworth-road, for improvements in self-capping fire-arms.

2064. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in ordnance and projectiles for the same,—being a communication.

2065. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in machinery for preparing fibrous substances for combing,—being a communication.

2066. Thomas Harry Saunders and Joseph Millbourn, both of Dartford, for improvements in the manufacture of paper.

2067. William Tranter, of Birmingham, for improvements in fire-arms.

The above bear date July 19*th.*

2068. Charles Ramsay, of New Bond-street, for an improved military cloak.

2070. Ernest Bazin, of Angers, France, for an improved electric railway carriage signal.

2072. Thomas Davey, of Tuckingmill, Cornwall, for improvements in the manufacture of gunpowder and explosive compounds.

2073. Alexander Morrison Fell, of Auchanard, N.B., for improvements in obtaining or manufacturing sulphate of ammonia and manure.

2076. Andrew Phillips, of Glasgow, for improvements in looms for weaving figured fabrics.

The above bear date July 21st.

2077. Thomas Meriton, of Hamburgh, for improvements in steam engine governors and speed regulators for machinery.

2078. Simeon Lord, and John Lord, both of Facit, near Rochdale, for improvements in carding engines.

2079. Paul François Cassagrain, of Paris, for improvements in fire-arms.

2081. Doctor William Smith, of Over Darwen, for certain improvements in power looms for weaving.

2082. Joseph Daniels, of Leigh, Lancashire, for certain improvements in artificial manure.

2084. William Edward Gedge, of Wellington-street, Strand, for an improved instrument for marking wadded or other stuffs,—being a communication.

2085. William Crofts, of New Lenton, near Nottingham, for improvements in the manufacture of fabrics by lace machinery, and in the means or apparatus employed therein.

2086. Henry Richard Summons, of Navarino-terrace, Dalston-road, for an improved apparatus for bordering envelopes, paper, and cards.

2087. Henry Richard Summons, of Navarino-terrace, Dalston-road, for improvements in machinery or apparatus for bordering envelopes, paper, and cards.

2088. Thomas King, of Truman's Brewery, Spitalfields, for improvements in apparatus for measuring malt, grain, and other granular substances.

2089. George Payne, of Grantham, for improvements in horse shoes.

2090. John Henry Johnson, of Lincoln's-inn-fields, for improvements in the treatment of the noxious gases or vapours produced in the distillation or purification of tar,—being a communication.

2091. Antoine Constant Vautier, of Paris, for improvements in obtaining fibrous materials, and in manufacturing paper pulp, also in preparing, bleaching, and treating fibrous materials and fibrous and textile fabrics, and in producing agents used in part of the invention.

2092. John Jay Haley, of South Dedham, Massachusetts, U.S.A., for an improved machine for wringing clothing and other woven fabrics,—being partly a communication.

The above bear date July 22nd.

2094. Zerah Colburn, of Tavistock-street, for improvements in apparatus for the condensation of steam in steam engines.

2096. Alphonse Vignon, of Southampton-buildings, for improvements in the means and apparatus for extinguishing fires either on land or water,—being partly a communication.

2098. Emile Alcan, of Coleman-street-buildings, for improvements in machines for combing and carding wool and other filamentous materials,—being a communication.

The above bear date July 23rd.

2102. John Horton, of New York, for improvements in breech-loading fire-arms,—being a communication.

2104. Henry Rawson and Frederick Staples, both of Leicester, for improvements in machinery for combing wool and other fibres.

2106. John Goffe Clarke, of Brackley, Northamptonshire, for improvements in scythes.

2108. William Clark, of Chancery-lane, for improvements in machinery for the manufacture of fishing and other nets,—being a communication.

The above bear date July 24th.

2112. James Anderson, of Allan Bank, Perthshire, N.B., for improvements in separating gluten from starch, and in preparing gluten for food.

2114. William Clark, of Chancery-lane, for an improved apparatus for decanting wine,—being a communication.

2116. William Clark, of Chancery-lane, for improvements in rafts or structures, applicable for the ordinary purposes of marine and inland navigation, as also for saving life in

cases of shipwreck or otherwise,—being a communication.

2118. Ebenezer Comfort, of Richmond-terrace, Grosvenor-park, Camberwell, for improvements in watch-protectors.

2120. Ephraim Tysall, of Riding House-street, Portland-place, for an improved manufacture of fork.

The above bear date July 25th.

2122. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for an improved mode of attaching armour plates to ships,—being a communication.

2124. Jasper Henry Selwyn, of Woodland Craig, Grassmere, Westmoreland, for improvements in apparatus employed in paying out and raising electric telegraph cables.

2126. Robert Low and William Duff, both of Dundee, N.B., for improvements in apparatus or means for producing an adjustable pressure on certain parts of machinery.

The above bear date July 26th.

2128. Henry Bollinger, of the Teesdale Iron Works, Stockton-on-Tees, for improvements in machines employed in ship building; part of which are also applicable to other purposes.

2136. Alfred Noble, of Bristol, for improvements in obtaining and treating compounds of alumina.

2138. John Ellis, of Kingston-upon-Hull, for improvements in apparatus for washing corn and other grain.

2140. Henry Hedgely, of Great College-street, Camden Town, for improvements in lamps.

The above bear date July 28th.

2148. Edward Thomas Hughes, of Chancery-lane, for an improved process of refining the slag from blast, puddling, and other furnaces; and the employment of the refined material for mortar, stones, slabs, ornaments, and other similar articles,—being a communication.—[*Dated July 29th.*]

New Patents Sealed.

1862.

188. T. Morris, R. Weare, and E. H. C. Monckton.
189. C. G. Hall.
194. Charles West.
197. D. Edleston and H. Gledhill.
198. E. A. Curley.
200. F. J. L. Lefort.
202. J. Brown and J. Davenport.
207. Ralph Martindale.
208. C. W. Harrison.
209. William Orr
214. H. H. Treppass.
222. S. C. Lister and J. Warburton.
229. J. H. Brierley.
236. J. B. Harby.
238. B. Foster and J. Moore.
242. Matthew Collier.
243. G. Phillips, sen., and G. Phillips, jun.
244. Matthew Allen.
245. Theophilus Gontarde.
247. James Firth.
249. William Davies.
252. Adolphus Lahousse.
253. David Littlehales.
257. Hermann Schatten.
262. P. Scheurweghs and A. J. A. H. De Boisserole.
264. E. H. C. Monckton.
269. William Smith.
278. Thomas Cook.
280. F. Riesbeck and W. Becker.
282. Lawrence Hill.
284. C. W. Lancaster.
288. William Clark.
289. T. M. Meekins.
290. George Manwaring.
293. J. L. Norton.
297. James Webster.
299. Daniel Gallafent.
300. W. E. Taylor.
308. J. B. Payne.
311. A. C. Bamlett.
315. P. H. Astley and C. Leighton.
320. John Tonkin.
322. R. A. Brooman.
324. Peter Shaw.
325. H. A. Silver.
328. William Clark.
330. W. H. Bartholomew.
335. Frederick Tolhausen.
337. James Carrington.
339. M. A. F. Mennons.
340. James Dickson.
345. George Smith.
347. William Clark.
351. Thomas Fyfe.
356. William Wood

358. John Brinsmead.
359. Richard Johnson.
360. Gustav Lindemann.
361. J. J. McComb.
362. F. J. Bolton.
363. John Hetherington.
364. G. J. Aman.
365. Frederick Tolhausen.
366. John Robb.
367. James Brickhill.
369. Andrew Hinshaw.
370. R. A. Brooman.
371. J. S. Joseph.
372. Thomas Spencer.
373. Alexander Samuelson.
374. Thomas Horsley, jun.
376. J. S. Joseph.
378. M. A. F. Mennons.
379. William Williams.
383. C. D. Abel.
384. Thomas Davison.
389. G. C. Burrows.
390. E. E. Allen and J. Stewart.
392. E. Green and J. Newman.
393. J. E. McConnell.
399. T. D. Macfarlane.
400. J. H. Johnson.
408. C. Turner and J. Shaw.
410. John Cooke.
413. J. Chatterton and W. Smith.
415. A. H. Harrison.
417. Jonathan Russell.
419. H. Crawford, J. Crawford, R. Crawford, and R. Templeton.
420. J. Hodgkinson and D. Greenhalgh.
423. E. T. Hughes.
424. T. and J. Birdsall.
425. James Combe.
428. Richard Watkins.
430. John Lees.
434. William Firth.
435. C. T. Marzetti and John Watson.
436. J. T. Pendlebury and George Pendlebury.
440. W. B. Adams.
441. Nathaniel Symons.
443. William Hinton.
444. William Davis.
445. James Paterson.
447. G. T. Bousfield.
448. James Willcox.
451. E. M. Stoehr.
455. James Paterson.
456. James Paterson.
457. Charles Wood.
459. James Spence.
460. R. H. Skellern.
461. Henry Ward.
463. William Hamer.
464. E. S. Crease.
465. R. Pickin and W. E. Pickin.
467. W. Mc Adam and W. Chrystal.
469. H. Chavasse, T. Morriss, and G. B. Haines.
470. William Ashton.
474. John Millington.
479. D. B. White.
483. W. B. Johnson.
484. M. A. F. Mennons.
491. William Clark.
492. T. N. Kirkham and V. F. Ensom.
498. W. E. Newton.
499. John Carnaby.
505. William Clark.
511. W. M. Cranston.
525. William Miller.
527. William Clark.
539. Thomas Bray.
547. J. C. Ratliff.
550. J. L. Charconchet.
565. S. G. Reynolds.
585. John Gjers.
595. John Sidebottom.
601. Edward Partington.
606. T. Hack and A. E. Carter.
624. S. S. Bromhead.
643. W. J. Bennett.
745. M. A. F. Mennons.
751. Thomas Dunn.
843. John Haworth.
856. W. E. Gedge.
896. Richard Burley.
904. W. M. Cranston.
922. W. C. Harrison and H. J. Standly.
994. John Whitehouse.
1182. Alexander Robertson and Richard Barter.
1185. J. H. Johnson.
1238. A. V. Newton.
1283. H. F. Broadwood.
1334. J. Victor, J. Polglase, and W. Rounsevell.
1350. J. H. Johnson.
1352. J. H. Johnson.
1371. William Gossage.
1380. Peter Tate.
1450. C. T. Porter.
1473. Charles Attwood.
1592. William Palmer.
1650. Leopold Chaubart.
1651. W. E. Newton.
1653. W. E. Newton.
1664. W. E. Newton.
1666. A. V. Newton.
1690. A. V. Newton.
1712. George Haseltine.
1798. J. H. Johnson.

*** *For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.*

NEWTON'S
London Journal of Arts and Sciences.

No. XCIV. (NEW SERIES), October 1st, 1862.

REPORT OF THE COMMISSIONERS OF PATENTS FOR INVENTIONS FOR 1861.

[*Ordered to be printed 7th August*, 1862.]

We have now before us the ninth report of the Commissioners of Patents, issued in pursuance of the Patent Law Amendment Act of 1852, and, in accordance with our annual practice, we shall proceed to give our readers an analysis of its contents. It would appear that so far from inventors having yet come to a proper sense of the benefits of unrestricted industry, as laid down by our modern dogmatic pseudo-political economists, there were no less than 3276 who petitioned, in the past year, for grants of letters patent. Of the large number of projects appended to these petitions, 2015 were embodied in a final specification; the remainder being abandoned at the earlier stages of the patent. The revenue derived from all sources amounted in the year 1861 to £102,030. 17*s*., as against £109,571. 18*s*. 6*d*. in the year 1860; While the expenses debited against the Patent Office fund were, in 1861, £46,567. 13*s*. 3*d*; and in 1860, £43,833. 10*s*. 9*d*. This shows a decline of rather more than £10,000 in the surplus income for the past year; but still a handsome surplus is available, if it can only be secured, for the special benefit of inventors.

In our review of the last Patent Office report, we referred to the forthcoming discussion, at Manchester, on the subject of Patent Law Reform, and we took occasion to show what was the aggregate surplus income available for carrying out the improvements that might be suggested with respect to the administration of the law. The discussion, however, which was conducted under the auspices of the British Association, was almost wholly confined to the policy of granting patents, and but little progress was consequently made in initiating a scheme for the establishment of a patent tribunal. It may be desirable, therefore, to re-consider the state of the Patent Office accounts, in order that the most recent information may be available both for the Royal Commission (appointed on the motion of Sir Hugh Cairns), whose sittings will shortly commence, to consider and report upon the administration of the patent laws, and also for those who shall be invited to give evidence upon the subject.

We find that the income of the Patent Office, since the passing of the Act of 1852, has been as follows:—In the years 1852-3 (fifteen

months), the gross receipts were £72,911. 8*s*. 6*d*.; in 1854, £53,864. 18*s*. 2*d*.; 1855, £74,819. 1*s*. 4*d*.; 1856, £92,477. 6*s*. 2*d*.; 1857, £85,351. 2*s*. 3*d*.; 1858, £84,952. 15*s*. 6*d*.; 1859, £96, 804. 8*s*. 5*d*.; 1860, £109,571. 18*s*. 6*d*; 1861, £102,030. 17*s*. During these years the expenses of the office have greatly fluctuated—chiefly owing to the irregular outlay in the six first years for printing the specifications; but in every year, except 1854, there has been a surplus, varying in round numbers from £7000 to £65,000. The following is a summary of the financial yearly results, after the payment of all expenses charged against the patent fund since the Act of 1852 came into operation:—

				Surplus.			Deficit.		
For One Year and a Quarter, ending Dec. 31st, 1853			... ...	£25,311	15	9			
For the Year ending		1854	... ...				£9639	10	4
"	"	1855	When the £50 Taxes first became due	23,076	10	4			
"	"	1856	... ...	26,714	15	5			
"	"	1857	... ...	7601	14	0			
"	"	1858	... ...	23,164	11	2			
"	"	1859	When the £100 Taxes first became due	52,406	2	2			
"	"	1860	... ...	65,738	7	9			
"	"	1861	... ...	55,463	3	9			
				£279,477	0	4			
			Deduct deficit	9,639	10	4			
			Total surplus income of the Patent Office	£269,837	10	0			

With this large and yearly increasing surplus income, the full amount of which, however, it is only fair to say, is not admitted by the Commissioners' report, it will be manifest that ample pecuniary means exist for carrying out such improvements as may be thought necessary for protecting and encouraging the inventive interest.* But if more funds were required, it would not be difficult to show that they might readily be found without further taxing patentees, or asking aid from the country at large. A mere glance at the items of expenditure of the Commissioners will show how small a sum really goes to keep up the present staff of the Patent Office. The expenditure of the past year (£46,567. 13*s*. 3*d*.) is made up mainly—Firstly, of fees to the Attorney and Solicitor-General and their clerks,—£9780. 4*s*. Secondly, of compensations to sinecurists and others who profited by the old system,—£4584; the chief portion of which sum is paid as a supplementary salary to the Attorney and Solicitor-General for Ireland and the Lord Advocate for Scotland, and their clerks, whose predecessors ob-

* The Commissioners' balance sheets of income and expenditure have of late years been prepared with deductions under the head of "reserve stamp duty account," which we hold to be a mere fiction, as there is no reason whatever why any portion of the revenue of the Patent Office that may be required for the encouragement of inventive skill and kindred objects, should be absorbed into the general revenue of the country. After the deductions made on this account, the available surplus fund stands, in the Commissioners' last report, at £129,000.

tained, under the old law, fees on the granting of Scotch and Irish patents. Thirdly, of payments for the printing of specifications and indexes of patents, £16,212. 7*s*. 2*d*.; which branch of business ought to be made to clear its own expenses, but which, in last year's transactions, shows a deficit a little in excess of £14,000.* If, now, we were to deduct these three items, which are not necessary for carrying out efficiently the proper business of the office, the expenditure would be diminished by some £28,000 per annum, without touching the question of the salaries of the staff, or considering the propriety of all the appointments, or even curtailing that little superfluity connected with the Museum at South Kensington, or that yet more assailable item "current and incidental expenses in the Patent Office." It must, therefore, be admitted, that the money question is the last that need trouble the Royal Commission, which must shortly take upon itself the duty, according to the terms of its appointment, "to inquire into the laws relating to letters patent for inventions."

As yet, so far as our information goes, nothing has been decided as to the direction in which this inquiry will be pursued, but it will be by no means premature to consider what subjects are most likely to be, or may most profitably be, pressed on the attention of the Commission. In the first place, although scarcely embraced by the terms of the appointment, there is little doubt that the recommendation of the Commission will be sought in support of a scheme of great magnitude shadowed forth in the Commissioners of Patent's report, for the erection of a Patent Office, including not only the necessary offices for the performance of the routine business, but also of a Public Library and a Museum capable of expansion to meet the growth of knowledge in all departments of science, and the economic arts, "It is intended," says the report, "to make the Patent Office Museum an historical and educational institute, for the benefit and instruction of the skilled workmen employed in the various factories of the kingdom; a class which largely contribute to the surplus fund of the Patent Office, in fees paid upon patents granted for their inventions." This is a proof of kindly consideration on the part of the Commissioners, that is deserving of all praise; but, unfortunately, the practical illustration afforded of the manner in which this blessing is to be administered is enough to make any thoughtful person pause before he commits himself to the encouragement of the scheme. The report goes on to say, "Exact models of machinery, in subjects, and series of subjects, showing the progressive steps of improvement in the machines for each branch of manufacture, are to be exhibited;

* The gross sum expended on the publication account to the end of the year 1861 (not including the cost of literary or official labour) was £244,904. 8*s*. 7*d*., and the amount received on the sale of specifications, indexes, &c., was £11,941. 2*s*. 2*d*., leaving a deficit of £233,063. 7*s*. 5*d*.

for example, it is intended to show, in series of exact models of machines, or in the machine itself, each important invention and improvement in steam propellers; from the first engine that drove a boat of two tons burden, to the powerful machinery of the present day, propelling the first-rate ship of war or of commerce." It is further added, and this is the gist of the matter, that "the original small experimental engine that drove the boat of two tons burden, above referred to, is now in the Museum, and it is numbered One in the series of propellers, or models of propellers."

Let us fancy now a workman, say from the establishment of Messrs. Penn and Son, of Greenwich, impelled with a desire to gather further information respecting his craft, and at some cost and inconvenience to himself, devoting a day to the inspection of the models, in the Patent Office Museum, relating to steam propulsion. Beginning with No. 1 of the series, he will come upon an engine of the rudest possible construction, and finding, at the same time, it was the production of a man whose name is in everybody's mouth as deserving the everlasting gratitude of mankind for his labours, he will, with his limited knowledge of surrounding circumstances, begin to wonder how any sane mechanic could produce such an engine, and why such a piece of rubbish should be deemed worth preserving. So far from gaining instruction, the odds are, that having come to learn, he will depart with a confirmed contempt for the mechanical knowledge and skill of his predecessors; for even the latest things he will find in the Museum will be behind the experience of his own shop, and judging from this test he will consider, and rightly so, that the Museum is in all branches behind the age. The fact is, that however curious the investigation of the early attempts to solve the great problems that are now patent to all the world may be to men of learning, they are worse than useless to "the skilled workmen employed in the various factories of the kingdom;" for not only is no practical knowledge to be gained by such investigation, but the evident short-comings of the men who have done good service in their day, cannot but impress on the minds of their successors their own manifest superiority, and thereby create a contempt for the men whose memories they ought to be taught to venerate, and whose acts of perseverance to emulate.

But irrespective of this very obvious result of the Patent Commissioners' scheme for the preservation and classification of mechanical "fossils," the power of such a Museum to absorb the surplus fund is beyond all calculation. Already a project is ventilated for securing the government property on which Fife House stands, its special merit not arising from its central position, but in that it lies adjacent to the Thames, from which, by means of the embankment now about to be executed by the Metropolitan Improvement Board, a large accession

of ground can be secured, that will permit of an indefinite accumulation of bricks and mortar thereon, as circumstances may warrant the extension of the building.

Without offering any obstruction to the erection of a suitable Patent Office, with a Library of sufficient capacity not only for storing the books already collected and the current scientific literature, but also for affording reasonable accommodation to the public for inspecting these treasures, we think there is a far more pressing subject, viz.:—the administration of the patent law, awaiting the consideration of the Royal Commission. This subject, in our opinion, possesses the first claim on the surplus fund, for it is manifestly useless to grant letters patent for inventions if no sufficient means is available for enabling patentees to enforce their rights. This is a matter that must not lightly be passed over at the present time; for it is certain that no steps will be taken to establish a special tribunal for the trial of patent cases, unless ample funds are available for the purpose; and it is quite as certain that it will require no little resolution on the part of contributors to the Patent Office fund to prevent the diversion from this object not merely of the whole of the existing surplus, but of that which may accrue from the transactions of many following years. A paragraph contained in a recent report of the Commissioners of Patents to the Lords Commissioners of Her Majesty's Treasury, on the subject of building a Patent Office, Library, and Museum, will explain the meaning of the above remark. After indicating a proper site, and showing that all difficulties which once existed relating to its appropriation are removed, they proceed to say—"The surplus income of the Patent Office applicable to building purposes amounts in the aggregate to £129,000*. *The Commissioners of Patents do not purpose to ask your Lordships to apply for building purposes any portion of this sum which has already been received and has formed part of the general revenue of the country, but merely that the surplus income of the present year* (1862), *and that of succeeding years, should be applied for the purposes above enumerated.*" At present it does not appear that the Government has given very great encouragement to this project; but should the request be acceded to, there would be an end, for many a year, to any improvement in the administration of the law. For observe, not merely is the whole of the accruing surplus asked for, but, as a sop to the Government, the Commissioners, who should be the guardians of the inventors' interests, abandon their claim on the Treasury to the £269,837. 10*s*. 0*d*. drawn from the pockets of patentees, and absorbed into the general revenue of the country. It is well that this little arrangement cannot be

* Reduced to this sum by the fiction of revenue stamp duties on patents, as already explained.

effected without the approval of Parliament, or the inventive world might awake some morning and find it a *fait accompli*. There would then, however, remain one resource which would be preferable to waiting in patience the final completion of the magnificent and costly scheme of the Commissioners, viz., making war upon the items of expenditure included in the Patent Office balance sheet, with the view of eliminating all such charges therefrom as would not bear the scrutiny of an impartial investigation. Considering that the consent of the House of Commons must be first obtained, in the shape of a grant, it will be seen how important to the furthering of the Patent Law Commissioners' views, a favourable report from the Royal Commission would be. We trust, however, that we have said enough to show that the carrying out of their design in all its fullness would, at the present time, be highly detrimental to the interests of inventors, and that such as may be invited to offer their opinions to the Royal Commission will not fail to embody that fact in their evidence. What would be the cost of a special tribunal we are not prepared to say: indeed it is at present premature to enquire, for that must depend greatly on the nature of its constitution, and the duties it may be designed to perform. Our present object is served if we have succeeded in showing that the Patent Office possesses a large surplus fund, which, if necessary, may be expanded by some £28,000 per annum, without increasing the tax on inventors; and that, ample as the pecuniary means are for effecting reforms in the administration of the law, they will not be found more than equal to the carrying out of the project which is now in favour with the Patent Commissioners.

Recent Patents.

To MARC ANTOINE FRANÇOIS MENNONS, *of Rue de l'Echiquier, Paris, for improvements in the treatment of coprolites and other fossil phosphates of lime,—being a communication.*—[Dated 10th February, 1862.]

THIS invention relates to an improved method of treating phosphates, by means of which these minerals are converted into a highly assimilable manure, and are rendered applicable for disinfecting certain animal products, and extracting fertilizing principles therefrom.

The nodules or rocky phosphates are pulverised as finely as possible, and with the powdered mass is intimately incorporated from 6 to 10 per cent. of organic matter, highly charged with hydrogen and carbon,—for instance, the pitch or tar produced during the distillation of coal in gas manufacture. The mixture is then calcined at a temperature of from 400° to 500° centigrade, in closed and luted kilns or retorts, each containing a minimum quantity of four hundredweight. In this process the tarry matter is decomposed; the hydrogen unites with the sulphur of the sulphuret of iron, forming sulphuretted hydrogen, which is thrown into the furnace

and there consumed. The carbon reduces the metallic oxides, divides the molecules, and assists the conversion of the sulphurets into carbonates, which afterwards pass to the state of oxides, the carbonate of lime especially being converted into oxide of calcium (quick lime). The water and carbonic acid are driven off, and the excess of carbonaceous matter takes their place. When the disengagement of gas ceases (generally in from half-an-hour to an hour, with the quantity above noted), the operation is suspended, and the product is withdrawn from the recipient, and placed to cool in sheet-iron dampers.

The compound obtained as above may either be employed directly as manure, or enriched by a suitable admixture of animal products, such as blood, fecal and liquid excretions, and other analogous matters, on which it acts as disinfectants. The product, consisting of black calcareous phosphate, finely-divided silica, lime, and a small quantity of oxide of iron and of ammonia, forms a valuable and highly assimilable manure.

The patentee claims, "the improved processes and combinations of matter, substantially as herein specified, by means of which coprolites and other fossil phosphates of lime may be converted into rich and assimilable manure, and at the same time be rendered applicable to the deodorisation of certain animal products, and to the extraction therefrom of fertilizing elements."

To JOHN ROBB, *of Aberdeen, for improvements in ventilation, and in apparatus employed for that purpose.*—[Dated 12th February, 1862.]

THE principle adopted by the patentee in carrying his improvements in ventilation into effect, is that of admitting the necessary supply of fresh air at a low level, and carrying off the heated and vitiated air at a higher level; a continuous movement of the atmosphere being thus kept up, while at the same time all disagreeable or hurtful effects from draught are obviated by the peculiar arrangements employed for that purpose.

In ventilating dwelling houses which have been constructed without any special appliances for ventilation, the cheapest and readiest manner of accomplishing the object is by making one or more windows the medium or media for the ingress and egress of the air. The upper sash is drawn down so as to leave a suitable opening, say of two or three inches, the lower sash being drawn up to a greater extent, the width of such opening being adjustable by raising or depressing the sashes. The ventilating apertures being thus adjusted, a current of fresh air will enter at the lower part of the window, while the upper opening will allow the heated and vitiated air to escape. The ventilating openings are covered with perforated or pervious material, a continual supply of fresh air being thus admitted into the apartment or other place to be ventilated; but the current of air being divided into minute streams by the structure of the interposed material, all unpleasant or injurious effects of draught are prevented. The material preferred for this purpose is perforated card paper, manufactured in sheets of a size to suit any ordinary window, and rendered waterproof by the application of a solution of india-rubber or other suitable waterproofing substance, ornamented as may be desired. The perforated or pervious material is framed in wood, metal, or other suitable material, and made to fit close to the window sashes, only leaving room for the latter to be freely drawn up or down. If desired, the lower portion may be so constructed and arranged as to form a blind, for which

purpose the perforated card paper is admirably adapted, as it is capable of being made highly ornamental. The perforations should be 400 to the square inch for the lower sash and about 200 for the upper opening. This plan is, however, subject to one defect, namely, the opening at the middle of the window will cause some draught, and also admit dust. To obviate this, the patentee proposes to fit or fix the perforated or pervious material into or upon the window sashes themselves, the glass or other material placed in the sashes in lieu thereof being made moveable, so as to adjust the openings for the ingress and egress of air.

In new, and even in old buildings where expense is not an object, the patentee effects the ventilation by means of special openings arranged upon the principles alluded to; the openings for admitting fresh air being in most cases near the level of the floor, and those for the exit of the vitiated air being placed in or near the ceiling or roof.

For ventilating churches, halls, and other buildings of large size, the fresh external air is admitted at the upper part of the building by a shaft or channel, and is conveyed by means of tubes or channels to chambers, which may be of any required size or capacity, and placed in any convenient parts of the building. The chambers do not require to be of great breadth, and they may therefore be conveniently constructed or placed in party walls, or behind ceilings, or in any other convenient positions; the chief requisite being that they shall possess a ventilating surface of sufficient area for the requirements of the particular cases for which they are employed. The ventilating surface is formed of perforated or pervious material, the air being thus transmitted from the chambers to the apartments or places to be ventilated at a low level; there being provided suitable tubes or outlets (covered with perforated material) at the upper part thereof, for the escape of the heated and vitiated air. The ingress and egress of the air is regulated by means of valves properly arranged for that purpose.

The shafts, tubes, or channels, for conducting the fresh air from the top or upper part of buildings, are made of earthenware, with glazed inner surfaces, and their upper ends are covered, to prevent the admission of rain or dust. The opening of the shafts, tubes, or channels at the lower part thereof should be somewhat above the floor of the place to be ventilated, especially when in halls, churches, or other large buildings, the floor is on or level with the ground.

In some buildings it may be a very convenient arrangement to employ the staircases or lobbies as ventilating shafts, in which case suitable openings must be made at the necessary points for admitting a full supply of the external fresh air,—such openings being at the same time protected so as to prevent draught, and the fresh air being carried into the ventilating chambers, and then diffused as before mentioned. In cold weather the temperature of the air in such staircases or lobbies so employed might be raised to a genial heat before being distributed, thus adding greatly to the comfort of those using the apartments or places in course of ventilation. In ordinary cases, also, the chambers may be formed or placed in the vicinity of a fireplace or furnace, by which means the air may be heated before being diffused.

The patentee claims, "the combinations and arrangements of apparatus for the purposes of ventilation, hereinbefore substantially described, or any mere modifications thereof."

To ALFRED VINCENT NEWTON, *of* 66 *Chancery-lane, for improved machinery for sewing,—being a communication.*—[Dated 9th August, 1861.]

THIS invention relates, firstly, to the use of an adjustable needle bar guide box, by means of which the vertical needle of the sewing machine, whether it be coarse or fine, can be brought to any required proximity to the shuttle and shuttle race; secondly, to the use of a needle guard, by means of which the needle will be protected from being struck by the shuttle in its forward movement; and, thirdly, to the throwing out of action of the presser foot.

In Plate VII., fig. 1 shows a side elevation of a shuttle machine with the improvements applied thereto; and fig. 2 is an end elevation with the cap or front of the needle bar guide box removed. This guide box is made in pieces B[1], B, and separate from the bracket arm or support A. The back part of the guide box B, is held at its upper part to the arm A, by a screw *q*, and at the bottom by a second screw *p*, around the stem of which a strong volute spring Q, is coiled. This spring is contained in a socket formed for it in the end of the bracket arm A, and is caused to bear against the back of the box B, by which means the box and needle bar receive a tendency to stand out from the bracket arm. The guide box may, however, be drawn up firmly against the arm A, but the rigidity of the spring is so great that the machine works equally well when the lower part of the box B[1], B, does not bear against the arm A. The distance which it may be required to move or deflect the box and needle bar is so slight that no joint or hinge is required at the top; the yielding of the upper holding screw *q*, being quite sufficient to allow for the requisite movement. The object of this arrangement is to enable a fine needle to be brought into as close proximity with the shuttle race and shuttle as a coarse one, and to allow it to play flush in the face of the shuttle race, and also, in case the needle is not perfectly straight, to ensure its acting in proper proximity to the shuttle race.

The second part of the improvements relates, as before stated, to the needle guard. It is well known that in sewing over uneven surfaces, the needle is frequently deflected into the shuttle race, when it is liable to be broken or injured by the shuttle in its advance movement. To prevent this, a guard or finger *c*, keyed to a rock shaft *d*, is employed. This rock shaft receives its motion from a pendent arm *e*, carrying at its lower end a bowle *f*, which works in a cam groove *g*. This guard or finger *c*, operates in the following manner:—At the moment the needle (after completing its downward movement) has receded to form the slack loop, the guard *c*, moves against the needle, its end bearing upon the needle stem just above its point, and it thereby presses back the point holding the needle in that position, until the shuttle has passed through the loop. The cam *g*, which affects this movement, through its operation on the pendent arm *e*, is placed upon the main cam shaft, and its action is so adjusted relatively to the needle and shuttle movement, that it will always insure the proper deflection of the needle before the shuttle advances.

The object of the last improvement is (when the presser foot is not required to be in action) to enable the operator of the machine to throw it laterally from the needle bar out of the way of the needle. The mode of effecting this will be readily understood by reference to figs. 3 and 4. The vertical slot *u*, fig. 3, provides for the upward movement, and the

horizontal slot *t*, leading therefrom, provides for the lateral movement, and forms a catch for holding the presser foot in suspension. *s*, is the thumb piece for lifting the stem *r*, of the presser foot.

The patentee claims, "First,—the means above described for adjusting the position of the needle relatively to the face of the shuttle or shuttle race, for the purpose above set forth. Secondly,—the guard or finger operating upon the needle, in the manner and for the purpose above described. And, lastly, providing for the lateral movement of the presser when raised, in the manner above described."

To JOHN DAVID NAPIER, *of Glasgow, for improvements in brakes,—being a communication.*—[Dated 6th December, 1861.]

THIS invention relates to the class of brake in which a friction strap or its equivalent is applied to the periphery of a wheel, pulley, or drum, the rotation of which it is desired to control, and has for its object to increase the efficiency of such appliances and to render them self-acting, or partially so.

The figure in Plate VIII. shows a friction strap, in which the strap *a*, is represented as applied to the periphery of a wheel or pulley *c*, fast on the shaft *d*, of the winding barrel; and the lever *e*, to which the strap *a*, is jointed, and by which it is controlled, is centred on a stud pin *f*, fixed in a projecting part of the frame *g*. In this modification, both ends of the friction strap *a*, are jointed to the one lever *e*, but both connections are to the same side of the fulcrum or fixed centre *f*; one of them, *b*, being at a greater distance from the fulcrum than the other, *h*. From this arrangement there arises a differential action between the two ends of the strap, of such a nature that the rotation of the wheel in one direction tends to free or open the strap, whilst rotation in the opposite direction tends to tighten or close the strap. This differential action consists in the joint *h*, of the strap, moving through a shorter space, in consequence of its being placed nearer the centre of motion of the lever *e*, than the other joint *b*, whilst the lever is moved slightly in one direction or the other through the strap itself, in consequence of the frictional adhesion thereof on the wheel rim. An adjustable weight is, by preference, applied to the lever *e*, in such a way as to tend slightly to tighten the strap and to insure there being always the slight adhesion between the strap and wheel rim which is necessary for the wheel to act on the strap.

In applying the improved contrivance to apparatus for raising and lowering heavy weights, the gearing and details are arranged so that the descent of the weight calls the tightening action into play, and the friction strap of itself holds the weight from descending. In order that the weight may descend, the lever *e*, must be slightly lifted or moved, to relieve the strap *a*, and must be held as long as required; as the descent of the weight would be stopped on the lever being left to itself. The force required to work the lever is very small compared with what is necessary in ordinary arrangements.

The arrangement may be beneficially substituted for the ordinary ratchet and pawl movement used to prevent the backward motion of weights or machinery, and it may be modified in its details to suit different circumstances and requirements.

The patentee claims, "the jointing of the ends of a friction brake strap upon the actuating lever at different distances from the centre of motion of the lever, and so that the turning of the lever causes both ends of the strap to move in the same direction, or in an equivalent manner; and the using of such arrangements as a self-acting appliance for preventing backward motion, substantially as hereinbefore described."

To DUDLEY CHARLES LE SOUEF, *of Twickenham, for an improvement in cylinders used in printing calicoes and other textile fabrics,—being a communication.*—[Dated 20th December, 1861.]

THIS invention consists in coating cast-iron cylinders with copper, by means of any of the well-known processes of electro-plating iron with copper. The copper surface thus produced on the iron cylinder or roller is then engraved with the desired pattern or design, and used in place of the solid copper rollers hitherto employed for printing calico and other textile fabrics.

The advantages of these rollers, in addition to the great economy of production, consist in the purity of the copper, which renders it particularly well adapted for engraving and etching, the design being more permanent than on the less perfect surface of the ordinary copper rollers. When the rollers are turned for the purpose of preparing them for a new design, they can be maintained at exactly the same diameter, by giving them a new coating of copper, at a trifling expense.

The patentee claims, "the use of cast-iron rollers, with a copper surface, for the purpose of printing calico and other textile fabrics, as described."

To WILLIAM EDWARD NEWTON, *of* 66 *Chancery-lane, for improvements in the manufacture of cube sugar,—being a communication.*—[Dated 30th December, 1861.].

IN the manufacture of cube sugar from what is known as "refined," and from other granular sugar, much difficulty has been experienced, partly owing to the want of some practicable method of rendering adhesive the grains or crystals of which the sugar is composed, and partly from the want of some practicable system of moulds, to produce the cubes with a moderate expenditure of power and with little manual labour. The object of this invention is to overcome these difficulties.

The first part of the present invention consists in exposing the grains or crystals (preparatory to their introduction into, or while on their way to, the moulds or cube-forming apparatus) to the action of steam, by which their surfaces are subjected to the necessary degrees of heat and moisture, to give them the requisite amount of adhesiveness to form the cubes. This part of the invention may be performed in various ways, and by the aid of various apparatus.

In Plate VIII., fig. 1 is a vertical section of the apparatus. A, is an upright trunk of quadrangular or other form in its horizontal section, fitted with a number of screens B, B, so arranged one above another, and inclined in opposite directions, that the granular sugar delivered on

to the top one will roll down it, and fall on to the next one below it, and so pass on from each one to the one below it, and from the lowest one, through an opening on one side of, and near the bottom of, the trunk; from whence it may be delivered directly to the moulding apparatus, or to any suitable receptacle, from or by which it may be carried to the moulding apparatus. The meshes of the screens B, B, are not large enough for the grains or crystals of sugar to pass through. C, is an endless band elevator, for conveying the sugar to the uppermost screen; D, is a steam pipe adapted to the trunk A, below the lowest screen, for the introduction of the steam, which ascends through the trunk and through the screens, thus passing through, among, and over the surface of the sugar, which is rolling down the screens, so that every grain will be subjected to its heating and moistening influence, and so have its surface brought to the adhesive condition necessary to permit the manufacture of cubes of sufficient tenacity to prevent their being easily broken or crumbled in packing or transportation.

The second part of the invention consists in the formation of the cubes by means of machinery composed principally of an endless or continuous series of moulds fitted with compressing and discharging pistons, and having applied, in combination with them, a cam or cams, or their equivalent, for operating the pistons, one or more at a time, in regular succession, throughout the whole series; so that if the moulds are regularly supplied with granular sugar, a continuous delivery of compactly-compressed cubes will be effected.

Fig. 2 is a front elevation of the machine, shown partly in section, and fig. 3 is a plan of the same.

A, is a rotary disc, in which are formed the moulds *a*, *a*. This disc is firmly secured to a vertical shaft B, which works in a fixed bearing on or in the framing C, and to which rotary motion is imparted by a pair of bevil wheels D, D^1, from a horizontal driving shaft E. The moulds consist of square holes in the disc, arranged in a circle concentric with the shaft B, or in two or more such circles, and each mould is fitted with a piston or plunger F, which enters at the bottom. The stems of these pistons work in guides or holes in a disc or plate G, which may be secured to the shaft B, by columns *g*, *g*, or to the disc A, or to both; and shoulders *b*, *b*, are provided on the stems to prevent the pistons from dropping out of, or descending too low within, the moulds *a*, *a*. Springs *c*, *c*, coiled round the pistons under the disc A, keep the pistons down with their shoulders *b*, *b*, in contact with the plate G, until they are forced upward, by passing over the face of the stationary cam H, which is secured to, or formed upon, the framing below the plate G. The springs *c*, also press the pistons down again after they have been forced up by the cam H. The lower ends of the stems of the pistons are furnished with antifriction rollers *d*, *d*, to facilitate their motion over the surface of the cam H, and this cam is so constructed and arranged, that each of the pistons will begin to rise just as it arrives under the stationary bar or plate C^1, which extends across the disc A, and constitutes the upper portion of the framing of the machine. After rising till its end is at a distance from the upper surface of the disc A, equal to the width of moulds *a*, *a*, the piston will remain stationary until it has passed some distance from under the bar or plate C^1, when it will rise until its end is flush with the upper face of the disc A. The first rise of the piston is to compress the sugar against the

under surface of the bar or plate C^1, so as to produce the adhesion of the grains or crystals and form the cube; and the second rise is for the purpose of discharging the cube from the mould. As it is desirable to have a very smooth surface to that part of the bar or plate C^1, under which the moulds and pistons pass, and which constitutes a top to the moulds, that part should be faced with a plate of glass, which will prevent the crumbling of the crystals at the upper surfaces of the cubes of sugar. The bar or plate C^1, might, however, be fitted with, or have substituted for it, a roller, against which the sugar might be compressed by the pistons. The disc A, rotates in the direction of the arrow shown in fig. 3, and the sugar is supplied to the moulds in suitable quantity, by being fed into a fixed trough I, which is arranged over the disc A, and which fits close to the disc: this trough has no bottom, save the bottom constituted by the disc itself. The lower edge of the end *i*, of the trough constitutes a scraper, to scrape off the sugar from above the moulds and leave it even with the face of the disc as they pass under it. After the sugar has been compressed into cubes in the moulds, and discharged therefrom by the action of the plungers, the cubes are carried round on the tops of the pistons, which, it will be understood, are then level with the upper face of the mould disc A, until they arrive at a stationary knife or thin-edged inclined plane of metal *j*, whose edge touches the surface of the disc; when, by the continued rotation of the disc A, they will be pushed up on to the knife, and be deposited upon a continuously moving endless apron J, by which they will be conveyed away to any suitable receptacle. The apron J, is supported by a roller *l*, working in bearings in two fixed standards K, and these standards also serve to carry the knife *j*.

The patentee claims, "the preparation of the granular sugar for the moulding or cube-forming apparatus in the manufacture of cube sugar, by submitting it to the action of steam, as herein specified. Second,—the apparatus herein set forth for the formation of the cubes in the manufacture of cube sugar, or any mere modification thereof, in which an endless or continuous series of moulds is provided with a corresponding number of pistons fitted to these moulds, and actuated by cams or their equivalent contrivances, as herein set forth."

To ROBERT JOHNSON, *of Liverpool, for an improved composition for coating the bottoms of iron ships, to prevent their fouling, and which composition may be used as a protective coating for wood, iron, or other substances exposed to the action of sea water.*—[Dated 10th January, 1862.]

THE object of this invention is to prevent the fouling of the bottoms of iron ships, and the wood, iron, and other substances used in the construction of marine works, by the adhesion of animal or vegetable matter thereto, and relates to a composition to be applied to the surface to be protected, by brushes, in a similar way to that now adopted in applying oil paint.

The improved composition consists of mercurial or blue ointment (a mixture of mercury and fatty matter), arsenic, and black-lead, in combination with drying oil, oil paint, or common coal tar, or black varnish. The ingredients are used, by preference, in the following proportions:—

About 2 pounds, by weight, of the mercurial ointment; 2 pounds, by weight, of powdered arsenic, with 6 pounds, by weight, of black-lead in powder, to one gallon of coal tar, or black varnish, or paint oil, or oil paint, or other suitable vehicle—coal tar, or black varnish, being preferred. The several ingredients are to be thoroughly mixed, by the use of a mill, or a pestle and mortar, or in any other convenient way. It is preferred to apply the composition over a coating of common coal tar or black varnish.

The patentee claims, "the composition described, or any mere modification of the same, as a protective coating for the bottoms of navigable vessels, and other surfaces exposed to the action of sea water, to prevent their fouling by the adhesion of animal or vegetable matter thereto."

To JAMES GORDON, *of Park House, Gateshead, and* BARTHOLOMEW HENDERSON, *of the South Shore, Gateshead, for improvements in the manufacture of ropes.*—[Dated 30th December, 1861.]

THIS invention has for its object the diminution of risk from fire by the ordinary use of boiling tar, in preparing the hempen yarn of which ropes are made, and also the preservation of the yarn from decay. For this purpose, instead of using the boiling tar, the patentees use coal oil, either alone or mixed with tar, in such different proportions as may be required for different kinds of rope, and either in a cold state or warmed. The invention thus consists in the substitution of coal oil, either alone or mixed with tar in suitable proportions, for boiling tar in preparing the hempen yarn. In other respects the manufacture of ropes is the same as usual.

The patentees claim, "the use of coal oil, either alone or mixed with tar in suitable proportions, in preparing the hempen yarn of which ropes are made."

To THOMAS ROBERTS *and* JOHN DALE, *both of Manchester, for improvements in the manufacture of gunpowder.*—[Dated 18th January, 1862.]

THIS invention consists in a method of manufacturing gunpowder, whereby nitrate of soda may be used in place of, or in combination with, nitrate of potash; the principle being to add thereto a substance which will effloresce, and thereby correct the tendency of the other material or materials to become moist. Of this class of substances, the patentees mention the anhydrous sulphates of soda and magnesia, the former of which they prefer to employ.

In order to obtain the anhydrous sulphate of soda, crystallized sulphate of soda is placed in a stove, at a sufficient temperature to drive off the whole of the moisture. Supposing nitrate of soda is used entirely instead of nitrate of potash, the patentees add a proportion of the anhydrous sulphate of soda, not exceeding eighteen per cent. of the nitrate, but less quantities may be used; and when mixtures of nitrate of potash and nitrate of soda are used, the proportion of the anhydrous salt to be added should be in such quantity as not to exceed eighteen per cent. of the nitrate of soda contained in the mixture, in order that the quantity of oxygen usually present in the materials used in the manufacture of gun-

powder may be maintained. The above ingredients are made into gunpowder in the usual manner.

The patentees claim, "the use in the manufacture of gunpowder of sulphate of soda, or other efflorescent substance, in combination with nitrate of soda."

To ROBERT OGDEN DOREMUS *and* BERN LUM BUDD, *both of New York, for improvements in making cartridges.*—[Dated 20th January, 1862.]

THIS invention has for its object, firstly, the formation of the ordinary granulated gunpowder of commerce into solid shapes suitable for use as cartridges and for other purposes; secondly, giving to the charge or cartridge so formed, the principle of acceleration; and thirdly, the forming of fixed ammunition by attaching the charge directly to the ball or to the sabot. Many attempts have been made to form a cartridge of granulated powder, which, without being enclosed or protected by paper, woollen, or other permanent casing, should yet retain its shape under the usual incidents of transportation and handling. In all these the prominent character has been that some adhesive matter must be introduced, or the powder has been damped with some moist substance, which was not perhaps a solvent of it; but these plans have failed, for the reason either that matter not necessary to the development of the full power of the powder is added, whereby, on burning, an undesirable residuum is left, or that the combustion is otherwise injuriously affected.

The patentees cause the granulated powder to take and retain the required forms by simple pressure in moulds of the desired shape. In order to prepare cartridges upon the principles above described, various degrees of pressure will be employed, according to the nature of the firearm in which they are to be used, or of the grain of the powder employed as well as of the projectile to be thrown. To prepare a cartridge, for example, for a six-pounder cannon, in which 1¼ pounds of powder would constitute a charge, a cylindrical mould is to be formed of some suitable metal, as brass, the bore of which is such that the cartridge to be formed therein will easily enter the gun. 1¼ pounds of powder are then to be introduced, and the piston fitted in; pressure is applied by means of any suitable machine, as a hydraulic press, until the powder has been condensed by a force equivalent to 15 tons weight. The piston is then to be taken out of the mould, and the powder discharged; when it will be found to have become completely compacted into a solid mass, which may be handled without risk of breaking, and in which shape the granular formation of the powder still exists.

In making charges which shall have different rates of combustibility in the same cartridge, the powder must be introduced into the mould in successive portions: thus, for obtaining three rates of combustibility, if the powder employed be all of one quality, it must be divided into three parts or portions; one portion is then submitted in the mould to pressure, say of 25 tons, then the piston removed and the next portion poured upon the first, and pressure again applied up to 20 tons; and, finally, the last portion is to be in like manner submitted to a pressure of 15 tons. The whole of the powder will then have been compacted into one mass, having three distinct strata, in each of which the

rate of combustion will be different, that portion having received the greatest pressure consuming more slowly than the other portions. It will only be necessary therefore to calculate the area of the bore of any other sized cannon, and the quantity of powder for a charge, to be able to apply the proper pressure to produce cartridges having the same rate of combustion, as in the case of those herein described. Inasmuch, however, as the uses to which cartridges of compacted powder can be put, and the results to be accomplished are so various, so must the shapes of the moulds and the pressures vary. The powder for accelerating charges may also be of different degrees of fineness or of strength, and may then be subjected to an uniform pressure throughout the cartridge.

The third feature of the invention lies in combining with a charge made as above, a ball or other projectile, without the aid of paper or other covering. If for small arms, the Minié bullet being employed, one of those is dropped into the mould, pointed end downwards; the appropriate powder for a charge is poured in, and then the due pressure is to be given. The powder will be at once properly compacted, and entering the hollow in the bullet will adhere to it with sufficient tenacity. The bullet may be cast with a projecting pin, if desired, and the powder compressed around that. In like manner the powder may be affixed to a sabot or a large shot. Whenever necessary, the cartridges thus compacted, may readily be reduced to the condition of granular powder, without detriment to its condition. The charge of powder, thus formed, may be rendered waterproof by applying a varnish of some substance which is insoluble in water, but which is not a solvent of powder, as shellac, collodion, stearine, wax, or other similar material. A coating of collodion is especially applicable for this purpose, as it will be consumed without leaving any residuum.

The patentees claim, "Firstly,—forming the ordinary granulated gunpowder of commerce into shapes suitable for use as cartridges, and otherwise, by compacting the same within moulds, by pressure so applied as to condense said powder into those shapes. Secondly,—giving to the cartridge the principle of acceleration, by forming it in strata of different rates of combustibility. Thirdly,—combining the ball or other projectile directly with the powder to form a fixed charge, in the manner set forth."

To JOHN BROWN *and* JOSEPH DAVENPORT, *both of Bolton, Lancashire, for an improved lubricating apparatus applicable to pistons.*—[Dated 25th January, 1862.]

THIS invention consists of a lubricator having two thoroughfares open to the steam, with a direct communication through the tap or plug, which may be placed in a horizontal or vertical direction.

The lubricator is constructed as follows:—A covered reservoir or cup, containing oil or other lubricating matter, is mounted on a vertical tube, the lower part of which is furnished with an ordinary tap or plug, which closes and opens its communication with a lower or double syphon passage, the opening of the tap or plug completing the communication, and *vice versâ*; the lower part of this double tube being screwed on to the cylinder, steam box, or pipe of a steam engine.

In Plate VII., fig. 1 is a front view, and fig. 2, a transverse vertical section of the improved lubricating apparatus. *a*, is the reservoir, mounted on a tube *b*, connected through a tap *c*, with a double syphon passage *d*: the tap is turned by a ratchet wheel *e*, fixed to a projecting stud *f*, and actuated by a lever and pawl *g*, which lever is worked by a tappet or excentric attached to the shaft of the engine, or by means of a rocking lever in connection with the beam or cross-head, or by any other method whereby motion can be communicated to the lever by the revolution or reciprocating motion of the engine. It will be evident that the steam passing from the steam cylinder up the large passage of the syphon pipe *d*, will force the lubricating material through the tap and down the small passage *i*.

The patentees claim, "the general arrangements and combinations of parts constituting 'an improved lubricating apparatus applicable to pistons,' substantially as described."

To ALEXANDER SAMUELSON, *of Cornhill, for improvements in hydraulic presses, and in the mode of working the same.*—[Dated 25th January, 1862.]

THIS invention relates to a peculiar combination and arrangement of pumping apparatus for hydrostatic presses, whereby a regular and unintermittent action is produced upon the rams of the presses operated upon, and a considerable saving of time and labour is thus gained.

In carrying out this invention two pairs of pumps are used, each pair consisting of a large and a small pump. One of such pairs of pumps is situate at one end and the other pair at the opposite end of a cistern containing liquid for supplying the pumps; each pair being placed at opposite sides of the fulcrum of a lever, which imparts motion to the plungers of such pumps, the plungers in each pair of pumps being connected to one cross-head, which is itself connected by a double link to the vibrating lever. The large pump on one side of the fulcrum is connected to the small pump on the opposite side thereof, by pipes communicating with one single stop, and this stop is in direct communication with one half of the double press, the other half of the press being in similar communication with the corresponding stop of the other large and small pumps, each single press having its own large and small pump and single stop.

In Plate VII., fig. 1 representsa side elevation (partly in section) of the improved arrangement of pumps and stops; and fig. 2 is a corresponding plan of the same.

a, is the cistern, from which the pumps are supplied with oil or water; *b*, b^1, represent respectively a large and small pump placed near one end of the cistern; and *c*, c^1, are the corresponding small and large pumps, placed near the opposite end of the cistern. Each pump is provided with a foot valve at b^*, b^{1*}, and the plungers or rams of each pair of pumps are both connected, as shown, to the same cross-head *d*, and d^1. *e*, e^1, are double links, which connect the two cross-heads to the lever *f*, on opposite sides of its working centre or fulcrum *g*, as will be clearly seen. The cross-heads are guided vertically by the guide rods *h*, *h*, working in the guides *i*, i^1, carried by the pedestal supporting the lever. Motion is im-

parted to the lever f, from any prime mover, by a link or connecting rod jointed to the end f^*, or other convenient part thereof, by a ball and socket, or other suitable joint. The large and small pumps, on opposite sides of the fulcrum, are connected by the pipes k, and k^1, which communicate respectively with the single stops at l, and l^1; thus the pumps b, and c, are connected by the pipes k, which meet at the stop l, whilst the pumps b^1, and c^1, are similarly connected by the pipes k^1, k^1, meeting at the stop l^1. The stops are opened and closed, as required, by the handles m, m^1, so as to bring the pumps into communication with the single presses, or to shut the pumps and open a communication from the presses to the cistern; a passage being made leading thereto from each stop, which is so arranged that, when elevated, the passage leading to the cistern from the press is open, and when lowered, this passage is closed, and the liquid from the pump is made to pass round the spindle of the stop and enter the pipe n, or n^1, leading to the press in connection therewith. o, o^1, are the ordinary safety valve levers in connection with the large pumps, as is well known in this description of machinery; and p, p^1, are the levers of the safety valves belonging to the smaller pumps.

The patentee remarks, that three pumps have been used in connection with a double hydrostatic or hydraulic press, and that four pumps have been used in connection with three double presses; but, by the employment of this invention, four pumps may be used in connection with one double press, thereby obtaining the continuous action described.

He claims, "the general combination and arrangement of pumps and stops for working a double hydraulic or hydrostatic press, as described."

To PIERRE SCHEURWEGHS *and* ALEXANDRE JOSEPH AURELE HENRY DE BOISSEROLLE, *both of Paris, for certain improvements in treating fatty and oily matters for obtaining their acidification, and in the apparatus employed therein.*—[Dated 31st January, 1862.]

ACIDIFICATION is an important operation in treating fatty and oily bodies to obtain the stearine therefrom, especially in the manufacture of candles and like articles. Hitherto when sulphuric or nitric acid has been used for this purpose, these acids have been employed in a cold state, and they have been used separately, that is to say, the two acids have never been employed together or simultaneously, but one or other of them have been used alone throughout the whole operation, or else one of them has been used after the other in different or separate operations. According to this invention, the acidification is effected by the simultaneous employment, in a hot state, of both sulphuric and nitric acids, that is to say, the fatty matters are treated with both sulphuric and nitric acids at the same time, the acids being employed in a hot state.

In carrying out this invention, the fatty matter is subjected to the usual preparation by washing it and by carrying on the usual process of evaporation, for which purpose it is heated to about from 110° to 115° centigrade, say 230° to 240° Fahr. Nitric acid at 32° to 35° Baumé, and sulphuric acid at 66° Baumé, are used at a temperature of about 110° to 115° centigrade, or 230° to 240° Fahr. The sulphuric acid is generally heated by a steam coil at the bottom of its receiver; but to raise the nitric acid to the desired temperature, say, 100° centigrade, or

212° Fahr., it is alcoholized, that is to say, there is combined with the acid a quantity of alcohol at about 65° Baumé, or even at a higher degree, preferably in a proportion of one-fourth part alcohol to every one part acid. The materials being thus prepared, the fatty matters are run into the apparatus in which they are to be acidified. This apparatus consists of a long inclined closed trough or series of communicating troughs, of square or similar section, constituting a passage, which may either be straight or it may be winding or zig-zag. The hot sulphuric acid is admitted into the trough near the entrance of the latter, and the nitric acid previously alcoholized, or treated with alcohol, is admitted a short distance beyond. The fatty matter passes all along the apparatus, and during its passage its heat is maintained by steam flowing through a false bottom, with which the apparatus is provided, and the fatty matter is combined, as explained, with the acids, which also combine with each other, and gas is given off therefrom; and this gas, being under pressure in the apparatus, assists in separating the glycerine and in solidifying or hardening the fatty matter.

In Plate VII., fig. 1 is a partial sectional elevation of the first arrangement of apparatus, termed the "passage apparatus." The fatty matter contained in the vessel A, is fed into the vessel B, which is the acidifying vessel. This vessel B, consists of a series of inclined troughs or shallow chambers of cast iron, of square section, communicating with each other so as to form a continuous winding passage. The inclination of the troughs should be very gradual (say $\frac{4}{8}$ths of an inch in the yard), and the whole passage should be ninety feet long from end to end; for the longer it is the more intimately will the acids combine, and the better will be the product. The vessels A, and B, communicate by a short pipe a^1, furnished with a stop-cock a. b, is the cover of the passage B, secured in place by screws c, which may be unscrewed, when desired, to allow of the removal of the cover, when the passage is to be cleaned; d, d, are false bottoms, under which steam is admitted by pipes e, e; f, is a mouth-piece, for feeding the sulphuric acid into the passage B; and g, is a mouth-piece for feeding the nitric acid into the passage. A vessel containing sulphuric acid is fitted over the mouth-piece f, and a vessel containing nitric acid over the mouth-piece g. At the end of the passage B, is a receiver, containing a steam coil; into this receiver opens an air pipe leading from an air pump. The fatty matter to be treated, after being prepared, as is customary, by washing, and by heating it to 212° Fahr., is fed into the passage B, by opening the stop-cock a, and will travel slowly along the passage from end to end, while steam is caused to flow continuously through the pipes e, under the false bottoms d, to maintain the temperature of the fatty matter at the desired point during its travel through the passage B. Sulphuric acid is admitted through the mouth-piece f, the acid being heated to the same temperature as that of the fatty matter, by a steam coil or otherwise. Nitric acid, heated by the admixture of alcohol, to about the same temperature as the fatty matter, or rather lower, is admitted through the mouth-piece g. The acids meet within the passage at g, and become incorporated with the fatty matter combining therewith and with each other during the remaining length of the passage B; and alcoholic, nitrous, and sulphurous gases will be given off from the heated acids, which being confined, and under pressure in the troughs, will act on the fatty matter, and will help to

decompose it, to separate its glycerine, and to effect its solidification. The cover *b*, should be screwed firmly down during the process, to exclude atmospheric air, and confine the gases given off from the acids. When the fatty matter has reached the end of the passage B, it will be discharged into the receiver containing the coil, where it is subjected to a current of air forced in from an air pump or otherwise, which completes the acidifying and solidifying processes, and also serves to correct flaws in the product, and expel unpleasant emanations. When the receiver is sufficiently full, a proportionate supply of water is let in to it, to wash the matters; steam being also admitted into the coil, completes the separation of the glycerine, and precipitates it. The stearine may be left to rest for two hours, or thereabouts, and is then poured off into the charging vat, and distilled in the ordinary manner; the remainder of the process being carried on as usual.

The patentee remarks that it is important to exclude atmospheric air from the materials, and especially from the nitric acid, as that acid, when used in an open vessel, imparts a reddish tinge to the fats, which renders them unfit for the market.

Fig. 2 is a sectional view of an apparatus, which may be used instead of the passage apparatus arrangement shown in fig. 1. E, is a cylinder for containing the fatty matter while being treated with acids. E^1, is a jacket into which steam is admitted through a steam pipe N; K^1, is an axle passing through the cylinder, and caused to rotate by a driving pulley G, or other ordinary means. This axle carries a number of arms, blades, or beaters K, K, set closely together, and extending nearly to the inner sides of the cylinder; these arms are dished at each end, the concavity at one end of each being curved in a reverse direction to that at the other end; so that on rotary motion being communicated to the axle K^1, the arms K, will beat and agitate the fatty matters thoroughly in all directions; the form and arrangement of the agitators may however be varied. The fatty matters are introduced into the cylinder E, from the evaporating vessel A, through a pipe P, and mouth-piece Q. Sulphuric acid and nitric acid, heated as before described, are admitted into the cylinder from their respective receivers R, and S, through suitable mouth-pieces. When in the cylinder, the acids combine with each other and with the fatty matters, on which they act simultaneously, and gases are given off from them (as in the apparatus fig. 1), which being confined under pressure in the cylinder, acidify the fatty matters, being assisted by the action of beaters or arms. The arrangement of the cylinder is such as to render the admixture of the materials continuous and gradual; an object which is assisted if the dimensions of the cylinder be about those above mentioned. The fatty matters, after being treated in the cylinder, are discharged through a pipe J, furnished with a stop-cock *j*, into a suitable receiver.

The patentees claim, "First,—the acidification of fatty and oily matters by the simultaneous employment of heated sulphuric acid and of alcoholized nitric acid, substantially as described, that is to say, by introducing heated sulphuric acid and alcoholized nitric acid into the fatty and oily matters, so that they shall act thereon at the same time, in the same operation, and with combined action, excluded from atmospheric air, and shall give off gases acting under pressure. Second,—the employment, in acidifying fatty and oily matters, of nitric acid, alcoholized or raised, by

the admixture of alcohol, to 212° Fahr., or higher, that is to say, to the same, or nearly the same temperature, as the matters treated therewith. Third,—acidifying fatty and oily matters, by sulphuric and alcoholized nitric acids, acting simultaneously and continuously upon fatty or oily matters, travelling along an air-tight passage, into which the acids are introduced in a heated state, and in which they combine with each other. Fourth,—the employment, for acidifying fatty and oily matters, of a long air-tight passage, arranged for the matters to travel along, while being treated by the acids, substantially in manner described. Fifth,—the employment of a cylinder, fitted with beaters or agitators, in manner and for the purpose set forth. Sixth,—the general arrangement and combination of parts, constituting the "passage apparatus." Seventh,—the general arrangement and combination of parts, constituting the cylindrical apparatus. Eighth,—the employment of a current of air to agitate and solidify the fatty or oily matters, after their combination with heated nitric and sulphuric acids, and thereby to perfect their acidification. Ninth,—the combined employment, in acidifying fatty and oily matters, of the three following improvements, that is to say, introducing into the hot matters sulphuric acid, raised to or to about the same temperature as the said matters (mostly at or about 230° to 240° Fahr.), causing the matters, while acted on, to travel along a long passage or duct, and subjecting the matters, after treatment with the acids, to a current of air, all substantially as and for the purpose set forth."

To CHARLES WILLIAM LANCASTER, *of New Bond-street, for improvements in strengthening cast-iron ordnance.*—[Dated 3rd February, 1862.]

THIS invention consists in removing the rear end of the gun, including the whole of the cascable, before or after the gun has been strengthened with wrought metal, in the form of a hoop or hoops, jacket or jackets, or both hoops and jackets, in forming a thread on the jacket or hoop, and in screwing thereon or therein, a wrought iron or steel breech end or cascable, so as to close the rear end of the gun.

The figure in Plate VII. shows, in longitudinal section, a piece of ordnance strengthened according to this invention. *a*, is the cast-iron gun from which the original breech has been cut; *b*, is a wrought-iron hoop surrounding the rear end of the gun *a*, and extending forward somewhat beyond the trunnions. This hoop is also prolonged to the rear beyond the point at which the cascable has been removed; a screw thread is cut in it, into which the wrought-iron or steel breech or cascable *c*, is screwed: *d*, *d*, *d*, are wrought-iron hoops surrounding the hoop *b*; and *e*, is an outer jacket. Any number of hoops may be used. Instead of the breech screwing into the hoop *b*, the breech and hoop may be made in one piece, and the hoop passed over the gun and the whole secured by the hoops *d*, *d*, *d*, and the outer jacket *e*, as before.

The patentee claims, "strengthening cast-iron ordnance by removing the rear end of the gun, and fitting thereto a wrought-iron or steel breech piece or cascable, substantially in manner described."

To JAMES WEBSTER, *of Birmingham, for improvements in gas fittings.*—[Dated 4th February, 1862.]

THIS invention refers, firstly, to improvements in the knibs or burners, and secondly, to the slides of moveable pendants or gasaliers. In making the improved knibs or burners, the aperture for the gas is cut in such direction that the flame jets out downwards, and then rises upwards slightly in a mushroom form. In the argand burner, the holes are perforated in a ring round the side of the burner, instead of upon the top: the effect of this arrangement is, that the air acts upon the flame immediately as it issues from the burner, and more perfect combustion is ensured. The improvements in the sliding parts of moveable pendants or gasaliers consist in the employment of a substitute for the balance weights and chains connected to the ordinary water slide.

In Plate VII., fig. 1 represents one of the improved single slit knibs or burners; fig. 2, one of the improved argand burners; fig. 3 shows, in vertical section, one of the improved slides; fig. 4 represents, in vertical section, a modification of the slide shown in fig. 3; and fig. 5 shows, in vertical section, a second modification of the improved slide.

a, fig. 1, is a single knib or burner, of the usual form employed for a bat's-wing burner. It is fixed on the inner edge of the gallery or glass holder *b*, and not centrally as with ordinary burners. The aperture for the gas is cut, as at *c*, in the form of a slit, and in a direction rising slightly towards the centre of the burner; this causes the flame to issue in a flat sheet downwards, the draught through the gallery driving it upwards and maintaining it in almost a horizontal position. To avoid the flame coming in contact with the glass, if a glass be required, it is preferred to make it of the form shown; so that by making the gallery sufficiently large to receive this form of glass, all danger of breakage from the heat is avoided. The slits are cut in the sides of the burner, instead of in front; that is to say, the flame issues in a line at right angles, or thereabouts, with the tube *d*. In this description of burner it is necessary to divide the stream of gas before it reaches the orifice for lighting, in order to avoid flickering in the flame; therefore the burner is divided internally by a metal diaphragm or partition, placed vertically within the burner, and forming two channels, each semi-circular in section. Fig. 2 shows one of the improved argand burners, in which the openings or gas jets are pierced around the sides of the burner, at a little distance from the edge, as at *e*, *e*, instead of upon the top of the burner; this allows the air to come in contact with the flame at the immediate point at which the gas issues from the burner, ensuring more perfect combustion.

Fig. 3 represents a section of one of the improved slides for gas pendants, by which the use of balance weights, chains, or pulleys, is avoided. *f*, is the fixed tube conducting the gas from the pipe to the burners; *g*, the water slide tube; *h*, the water cup, on which is fixed a stuffing box *j*, tapped internally to receive the screw cap *k*; *l*, is a metal runner, which may be formed either with overlapped edges or not quite closed into a tube, so that its capability of being expanded or contracted may not be destroyed. This runner is placed round the fixed tube *f*, and over the runner is placed a thick piece of vulcanized india-rubber *m*, which acts as a spring, closely binding the metal runner upon the fixed tube, and thus causing a certain impact between the runner and fixed tube. The

force of this impact is increased by every additional turn of the screw cap *k*, which, as it compresses the india-rubber vertically, compels it to exert its force horizontally, and thus close the metal runner more firmly round the fixed tube, by which it makes the impact between the runner and the fixed tube sufficiently strong to support the requisite weight. In this manner, the screw cap *k*, acts as a regulator, by which the strength of the slide may be adjusted to the weight to be maintained. A modification of this description of slide is shown in fig. 4, in which, in lieu of the metal runner and india-rubber spring, two metal springs *o*, are employed, each lined with a leather or other pad *p*. These metal springs are nearly semi-circular in cross section, and are pinned loosely to a ring or collar *r*, within the stuffing box: the screw cap *k*, acts also, in this instance, as a regulator, for, as it is screwed down, it causes a greater length of the spring pad to impinge against the fixed tube, and thus produces a greater amount of friction between the pad and the tube, and enables the slide to sustain a greater weight. The same result is attained by the arrangement shown in fig. 5, in which the stuffing box is tapped with a tapering screw *s*, whilst the cap is made with a parallel-sided screw, slotted to enable it to bear a certain amount of contraction without producing a "set." In screwing down this cap, the internal or female screw being tapered, it follows that the male screw will be closed round the fixed tube, and thus produce the necessary amount of friction to support the weight.

The patentee claims, "the several improvements in burners and fittings for gas, and in slides for pendant gasaliers, as set forth."

To George Manwaring, *of Southampton, for improvements in flushing apparatus for closets, sewers, and other water services.*—[Dated 4th February, 1862.]

This invention relates to apparatus for regulating the supply of water to water-closets, and also for flushing sewers, &c. To effect this object, water is supplied through a cistern connected to and working with a small supply cock or inlet valve, to which an air vessel is applied; by which means the supply valve can be worked against any pressure with ease, the large outlet or discharge valve from which is closed, while the inlet valve is opened, and *vice versâ*.

When the apparatus is applied to work self-acting, the closet seat may be hung on pivots or hinges, to allow the seat to decline about three-quarters of an inch. When the closet is occupied by a person, it is thus kept down. The connecting wire from the seat presses the end of the working lever down, which closes the discharge valve and opens the supply valve, and allows the cistern to fill with water to the required height. When the cistern is filled, the supply valve closes; all then remains stationary until the person using the closet rises from the seat. The return of the seat to its original height, by means of a spring or weighted lever, allows a counterweight or weighted shaft to raise the working lever and a connecting rod which opens the discharge valve, and the supply of water in the cistern descends through the down pipe to the pan of the closet, which flushes the soil away to the sewers.

The figure in Plate VII., is a section, showing the cistern filling with

water, and the fittings in their respective positions, the supply valve being open and the discharge valve closed.

A, is the cistern; B, B, the inlet or water supply valve to the cistern; C, the air vessel for the supply valve; D, D, a floating ball and lever; E, the connecting rod which regulates the working of the ball lever: the rod at the top end is attached to the working lever G, and the lower end to the discharge valve H, for the purpose of opening and shutting the same. F, F, F, is the weighted shaft, the working arm or lever of which passes through the connecting rod E, near the top part thereof, for the purpose of guiding the rod E, and working against the under part of the joint of the working lever G: the fulcrum of this lever vibrates in a hole at the end part of the cistern. H, is the discharge valve; I, I, the brass seat of the discharge valve, with union joint to connect the discharge pipe; J, J, the water line of the cistern when full; K, the connecting chain or wire from the lever to the closet seat, or from the lever for hand pull.

To EDWARD TAYLOR BELLHOUSE *and* WILLIAM JOHN DORNING, *both of Manchester, for improvements in the construction of hydrostatic presses suitable for packing and compressing cotton and other materials.*— [Dated 6th February, 1862.]

THIS invention consists of a novel arrangement and combination of hydrostatic cylinders and rams, with other mechanical contrivances for compressing and packing into bales cotton, wool, yarn, fibre, hair, or other compressible materials.

The figure in Plate VII. represents, in vertical section, the improved hydrostatic press, as constructed for the packing of cotton.

The essential feature of novelty in this press is the combination of vertical and horizontal pressure exerted upon the same bale in one operation. The ram heads a, and a^1, of the vertical and horizontal presses, respectively, work within their corresponding vertical and horizontal boxes or cases b, and b^1. The cotton or other material to be compressed, is introduced into these boxes or cases through suitable apertures closed by hinged doors or otherwise. One of these doors on the casing b^1, of the horizontal press, is shown at c. The spaces above and in front of the ram heads having been filled with cotton, the table or ram head a^1, of the horizontal press is forced by the ram laterally until it becomes level or flush with the side of the box or casing b, of the vertical press, as shown by the dotted lines. The ram head or table a, of the vertical press is now caused to rise, and the already partially compressed cotton is further compressed in a vertical direction until the whole is contained within the small space between the ram head or table a, and the top of the vertical press. The upper part of the box b, is then opened by hinged doors, so that the bale may be covered with canvass and corded or hooped in the usual way,—a chain and counterweight d, or other suitable contrivance in connection with the horizontal ram a^1, serving to draw it back so soon as the water is allowed to escape out of the horizontal cylinder, so as to lie in readiness for a fresh supply of material.

The ram and table of the vertical press are allowed to descend by their own gravity after the bale is completed, and the making of another bale is proceeded with. If desired, two or more horizontal presses, in whatever

relative position, may be combined with a vertical press, or four horizontal presses may be combined with a vertical press. In lieu of placing the supplementary presses in a horizontal position, they may, if preferred, be placed in oblique positions at any angle desired.

Instead of having the whole of the presses worked by hydraulic power, it is proposed, in some cases, to work the horizontal or supplementary presses by suitable mechanical movements, giving the desired amount of pressure; but in all cases the final vertical pressure is given by a hydrostatic press.

The patentees claim, "First,—the general construction and arrangement of hydrostatic presses, as described. Second,—the application and use, in combination with a vertical hydraulic press, of one or more horizontal or inclined presses, actuated according to the hydraulic principle, or by any convenient mechanical contrivance, so as to impart a lateral and a vertical pressure to the cotton or other materials under treatment, as described."

To Thomas Coltman, *of Leicester, for improvements in sewing machines.*—[Dated 12th February, 1862.]

The object of this invention is to produce a fast or secure stitch, which is not liable to be drawn out, and which is also an elastic stitch that cannot be broken by pulling or stretching the cloth or work.

In Plate VIII., fig. 1 is a side view of a sewing machine constructed according to this invention; fig. 2 is a front view of the same; fig. 3 is an elevation of the rear end of the machine; fig. 4 is a longitudinal vertical section of the lower part, showing the feed motion, and one of the needle carriers; and fig. 5 is a transverse vertical section, taken in the line 1, 2, of fig. 4. *a, a,* is the driving shaft, on which is keyed the driving pulley *b.* At the outer extremity of the shaft *a,* is the crank *c,* which is coupled by means of a double connecting rod *d,* to the two cranks *e,* and *f,* secured to the ends of the two shafts *g,* and *h.* The upper shaft *g,* actuates the upper needle bar, and the lower one *h,* actuates the lower needle bar and feeding rings, hereafter described. Each needle is supplied with thread from a separate bobbin i^1, and i^2. It will be seen, on reference to fig. 2, that the reciprocating needle bars *i,* and *i**, are so placed as to work up and down in guides *j,* and *j**, at an angle to the bed of the machine and to each other, and they are actuated in the following manner:—At the foremost end of the shafts *g,* and *h,* are secured plates or discs *k,* (see figs. 2 and 4), provided with annular grooves, which are cut excentrically to the axis of their respective shafts. Pins or studs projecting from the under side of the needle bars *i,* and *i**, take into these annular grooves; so that on the rotation of the shafts *g,* and *h,* the needle bars, with their respective needles, will be moved up and down, as will be readily understood, and the two needles will alternately pass a loop of thread through the cloth or other material to be sewn, and also through the loop previously formed by the other needles; that is to say, the upper needle, for instance, will descend through the cloth and form a loop on the under side of the cloth; the lower needle will then pass up through this loop and also through the cloth, and form a loop on the upper side, through which the upper needle,

which will have been drawn out of the cloth, will pass on its second descent, and so on; each needle passing in turn through the loop formed by the other, and forming a firm and elastic stitch, such as that shown in the diagram, fig. 6. Guides *l*, *l*, are provided for the purpose of keeping the needles steady in their proper place, and ensuring their passing each other properly. In order to feed forward the cloth or other material to be sewn, the following arrangement is employed:—Two toothed or roughened annular rings *m*, and *m**, (seen best in figs. 1, and 4,) are made to work smoothly round on the fixed segmental projecting piece *n*, which is cast on the front of the main framing of the machine. On the foremost end of the lower shaft *h*, and at the back of the disc *k*, is placed a sort of double screw cam, worm, or projecting feather *o*, (see fig. 4); the projecting feather or thread of this cam or worm takes into a worm wheel *p*, on the shaft of which is mounted a worm *q*, which gears into teeth cut on the back of the annular ring *m**, (see fig. 5). It will now be understood that when the shaft *h*, is rotated, an intermittent forward motion will be imparted to the ring *m**, through the worm wheel *p*, and worm *q*. This motion is communicated to the other ring *m*, by means of a roller *r*, covered with caoutchouc or other suitable material, and placed so as to press upon the roughened surfaces of both rings. In order to alter the length of the stitch, the worm *q*, must be changed for another worm of a different pitch, according to the particular length of stitch required. This, of course, will alter the motion of the feeding rings *m*, *m**, and will modify the length of stitch accordingly. The cloth or other material is kept down upon the rings by means of the presser foot *s*. It will be obvious that the feeding rings *m*, and *m**, may be operated in other ways, as, for instance, by means of friction rollers or toothed wheels, placed so as to work against the inner periphery of the rings.

The patentee remarks that while the sewing operation is proceeding, one or other of the needles will always be in the cloth or fabric, even while the latter is being fed forward: these needles must therefore be made so elastic that they may, without risk of derangement, be bent out of a straight line by the onward motion of the work; but immediately they are drawn out of the fabric they will spring back into their normal position, ready to make a new stitch in a fresh place. Figs. 7 and 8 are side and edge views of one of the needles, which, being made flat, as shown, possesses a considerable amount of elasticity. The combined movements of the needles and feed motion are as follows:—The top needle having been passed through the cloth, and having commenced to return, the feed motion for carrying forward the cloth commences and moves the work forward, and in so doing springs or bends the needle on one side. At the same time the needle, by being drawn back, opens the loop and allows the bottom needle to enter such loop, and pass in its turn through the cloth or work in a fresh place. The feed motion then carries the cloth onward a second time, while the bottom needle is inserted therein; and while withdrawing the needle, a second loop is formed, through which the top needle is passed; and so on, each needle alternately remaining in the cloth while the latter is fed forward. When it is required to remove the work from the machine, both needles must of course be drawn out of the cloth. This is effected by mounting the bottom crank *f*, loosely on the shaft *g*, so that the crank may be turned back one half

of a revolution without moving the shaft. It will be evident, therefore, that when the bottom needle is out of the work, the cranks *e*, and *f*, may be turned back, so as to raise the upper needle out of the work also. The table *t*, of the machine upon which the work to be sewn is placed, is made moveable, so that it may be slidden back in order that the needles may be got at with facility for threading or adjustment. In order to remove the table *t*, the piece t^1, which slides in a dovetail groove, must be drawn out, and the set screw *u*, unscrewed. The table *t*, may then be slidden back upon the rods *v*, *v*, and access may then be obtained to the needles. If it be found necessary to remove the table *t*, altogether, the rods *v*, may be unscrewed and drawn out, and the table may then be lifted off.

The patentee claims, "the mode, herein set forth, of arranging, combining, and working the needles, so as to produce the elastic lock stitch as shown and described; also the mode, herein set forth, of feeding forward the work, and the arrangement of parts for working the feed motion."

To Richard Archibald Brooman, *of Fleet-street, for improvements in preparing and ornamenting cast iron and other metals, in order to fit them for articles of furniture and decoration, and other similar uses,—being a communication.*—[Dated 12th February, 1862.]

The chief object of the invention is to render cast iron, suitable for articles of furniture, free from all liability to oxidation, and to ornament it by the application of the coloring and decorative processes used to ornament ceramic wares. In order to apply the ornamentation, it is necessary the metal should receive a preparation, that is, it must be covered by a vitrified varnish, upon which the ornamentation or decoration is applied. This coating may be obtained in all colors, by employing, in a dry state, as hereafter stated, opaque enamels in a proper state of fusibility for spreading over the metal, together with coloring oxides used in vitrifiable colors. By this invention, imitations of marble, precious stones, and various woods, are among those obtained on cast iron and other metals.

The method of proceeding is as follows:—The pieces of metal, say, cast iron, are cleaned and washed, and placed in a furnace or muffle heated to a red heat: as soon as the metal has attained the same temperature as the furnace it is withdrawn, and the enamel is sifted on it. When the metal is evenly covered with the enamel, it is again inserted in the furnace, where it is kept until the enamel forms a beautiful glaze. Uncolored enamels produce—by combining with the oxide of iron, which forms on the surface of the heated metal—a vitrification having the appearance of black marble. When cool, the enamelled surface may be ornamented in colors with a brush, as practised on glass and pottery. Imitations of marbles, woods, and stones of different colors are also produced by a brush, in any design, according to the taste and skill of the artist. Gilding and silvering are applied on the enamel as on glass and porcelain, but in order to heighten the effects produced, as before described, the patentee applies metallic and other lustres, varied by mixtures of colors with the metallic lustres, or by the action of smoke on the lustres. After the colors and lustres have been applied, the enamelled metal is again

placed in the furnace. The lustres, which are developed by the action of gas or smoke on colors containing oxide of silver, permit of a more extended application than has hitherto been obtained on porcelain or pottery, and this is owing to the workman being enabled to remove and examine the metal, while red, without its being liable to break from a draught of air, as would be the case with porcelain. To facilitate the operation of smoking the lustres, as the pieces issue from the muffle, they are placed in a closed vessel, where, by means of a tap, wood smoke, gas, or steam, is introduced. This tap is placed in communication with a smoke or gas receiver, by means of a caoutchouc tube; so that when the action is only required on one part, an attendant directs the gas to that part. The furnaces or muffles are made in proportion to the size of the articles to be manufactured, with a door at each end. To avoid as much as possible loss of heat, these doors are made of fire-brick held in a metal frame. In order that the doors may open and close with facility, they are fitted and work in slides placed at the sides of the entrance: they are each suspended at the end of a lever, at the other extremity of which there is a counterweight.

The patentee claims, "the improvements in preparing and ornamenting cast iron and other metals, in order to fit them for articles of furniture and decoration, and other similar uses, in manner hereinbefore described."

To THOMAS DAVISON, *of Belfast, for improved means for preventing the corroding of steam boilers.*—[Dated 13th February, 1862.]

THE object of this invention is to prevent the corroding of steam boilers in which the same water is repeatedly re-used, as in the case of marine and other boilers working in connection with surface condensers. To this end, the patentee introduces into the water a salt or salts (such as the carbonate) of soda, potash, or lime, capable of neutralizing the corrosive action of the injurious agent present in the water. The proportion of the salt required in any case will depend upon the quality of the water used in the boilers, upon the intervals at which it is convenient to renew the water, upon the management of the boiler and engines, and upon the quantity and kind of oil, grease, or other lubricant used in those internal parts of the engine exposed to the steam, and from which it is carried into the boiler by the steam and feed water. In general, there may be added to each gallon of water from about ten ounces of a carbonate salt down to a quantity barely sufficient to render the water alkaline, and equivalent proportions in the case of other salts.

For ordinary cases, carbonates of soda or potash may be used, or soda, potash, or lime in a caustic state; but special impurities may require the use of phosphates or nitrates of soda or potash.

The patentee claims, "preventing the corrosive action in steam boilers, in which the same water is repeatedly used, by the use therein of chemical substances, as described."

To JOHN CHATTERTON, *of Highbury, and* WILLOUGHBY SMITH, *of Dalston, for improvements in telegraph cables.*—[Dated 15th February, 1862.]

THE object of this invention is to render submarine cables incorrodible, and it consists, firstly, in coating each wire, or strand of wires or strips, which are to be used for the external protection of the core or insulated conductor of the cable, with lead or other soft metal incorrodible in sea water. In carrying out this part of the invention, the patentees use an ordinary hydraulic lead pipe-making machine, but instead of the solid core or mandril, upon which the pipe is formed, a hollow or tubular mandril is used, of sufficient length to reach nearly to a steel die, which forms the outer diameter of the lead covering, and in the centre of which the mandril acts as a guide to keep the iron or steel wire intended to be covered, concentric. When the machine is in action, the lead or other soft metal or alloy is expressed through the annular space between the wire and the die, and at the same time the wire, as it receives the coating of lead or alloy, is drawn away by the usual take-off motion, and is coiled up in a finished state. The wire is, by preference, tinned by the well-known process, before passing it through the lead covering machine. Instead of tinning the wire it may be passed through a vessel containing an adhesive compound, such as marine glue, or Hay's glue, or other suitable compound, maintained in a liquid state by heat immediately before it enters the lead covering machine: by either of these methods complete adhesion between the wire and the lead covering is obtained.

Secondly, the invention consists in coating strands of wires, by preference, strands composed of three wires of iron or steel, with a suitable compound and gutta-percha. The "serving" generally used may be dispensed with, the gutta-percha covering acting as a cushion between the core and metal protecting wires. This part of the invention is carried into effect in the following manner:—The strands of wires are coiled on a reel, and placed in a suitable position to enter a vessel containing an adhesive compound, such as that described in the specification of Willoughby Smith's patent, dated 9th August, 1858; and thence each strand passes through an ordinary gutta-percha covering machine, where it receives a sufficient coating of gutta-percha: it then passes through the cooling trough, and is coiled in a finished state. When the gutta-percha coating is dispensed with, marine glue, or Hay's glue, or other suitable compound, is used, mixed with about 10 per cent. of fibrous material, such, for instance, as "shoddy." This mixture is put into a vessel, fitted with suitable gauges or dies, to regulate the thickness of the coating; the strand is passed through this vessel, and becomes coated with the mixture, and then goes into a cooling tank until hard enough to be coiled. Sometimes marine or Hay's glue, or other suitable compound is used, with or without the fibrous material, as aforesaid, and as soon as the strand has received a coating of the compound, tape is applied, by means of an ordinary taping machine: the strand is thus coiled, without passing it through the cooling tank. A second coating of tape may be simultaneously applied. The strands of wires, coated by any of the described methods, are then laid around the insulated conductor or conductors by the usual cable-making machines.

The patentees claim, "First,—coating or covering the wires or strands

of wires, which are to be used for the external protection of the insulated conductor or conductors in telegraph cables, with lead or other soft metal or alloy, whether such wires be previously tinned or coated with an adhesive compound or not. Second,—coating or covering strands of wires (each strand composed, by preference, of three wires, to be used for the external protection of the insulated conductor or conductors of telegraph cables), with an adhesive compound and gutta-percha, as discribed. Third,—coating or covering such strands of wires, as aforesaid, with a mixture of marine glue, or other suitable adhesive compound, and fibrous material, as described. Fourth,—coating or covering such strands of wires, as aforesaid, with marine glue or other suitable compound, mixed with fibrous material or not, and with one or more coatings of tape or other like suitable fibrous material."

To THOMAS *and* JAMES BIRDSALL, *both of Leeds, for improvements in preparing hides or skins for tanning.*—[Dated 17th February, 1862.]

THIS invention relates to means of killing the lime which is employed in the process of removing the hair from hides or skins previous to the tanning process. Heretofore, after the hides have been subjected to the process of "liming," they have been put through another process called "bateing" or "pureing," consisting of steeping them in the dung of certain animals or fowls dissolved in water, which kills the lime and opens the pores of the hides or skins; the residuum of lime, dirt, and other matters being afterwards worked out or extracted by well-known means, but which is a very filthy and disagreeable process, and occupying a considerable length of time. To remedy this, the patentees employ, instead of dung, a solution of hydrochloric acid, diluted to about 1010° specific gravity, in which the hides or skins are submerged.

In carrying the invention into practical operation, the patentees remark that although 1010° specific gravity may be considered an average strength for the solution of hydrochloric acid in ordinary cases, yet it is necessary to vary the strength, more or less, according to the condition of the hides or skins, in order to produce the effect required upon them; and, in some cases, it will be advantageous to add a little sulphuric acid to the solution. This solution is also applicable to preparing hides or skins for currying.

The patentees claim, "the use or employment of hydrochloric acid, in manner and for purposes substantially as described."

To WILLIAM FIRTH, *of Burley, Leeds, for improvements in machinery for digging or turning up soil.*—[Dated 18th February, 1862.]

THIS invention relates to a novel arrangement of machinery whereby the operation of digging or turning up soil may be expeditiously and economically effected.

The figure in Plate VIII. represents the improved digger in side elevation: it consists of a carriage *a*, *a*, mounted upon two pairs of wheels *b*, *b*, and b^1, b^1. Attached to the framing of this carriage is a pair of L-shaped brackets *c*, *c*, which serve to carry, at their extremities, two horizontal

shafts *d*, and *e*. The large surface wheels *b*, *b*, are used as driving wheels for operating the diggers or picks used for turning over or disturbing the soil. Bolted to the arms of these wheels are the spur wheels *g*, into the teeth of which gear the pinions *f*, keyed to the extremities of the shaft *e*. Upon this shaft are also mounted a series or number of excentrics *h*, carrying excentric straps, from which depend arms *i*, *i*. Fitted to the lower end of these arms are the diggers *j*, which may be made of any appropriate form, to suit the kind of work in hand, as will be well understood by any agricultural implement maker; the diggers or picks being inserted in, and properly secured to, sockets formed to receive them. Keyed to the opposite ends of the shaft *d*, are pinions *k*, of the same pitch as the pinions *f*, and gearing like them into the spur wheels *g*. Upon the shaft *d*, is also mounted a series of excentrics *l*, similar in number to the excentrics *h*, on the shaft *e*. These excentrics *l*, are severally connected by excentric straps and arms *m*, to one of the pendent arms *i*, by a loose joint *n*, and are intended to give the requisite backward and forward movement to the picks or diggers *j*, while their up and down motion is obtained from the throw of the excentrics *h*.

By the revolution of the large surface wheels *b*, and, consequently, of the spur wheels *g*, effected by the draught or propulsion of the implement over the ground to be operated upon, the excentrics *h*, and *l*, are, through the pinions on their respective shafts, set in rotary motion; and thus a compound up and down and backward and forward motion is communicated to the pendent arms *i*, which carry the picks or diggers *j*. To facilitate the action of the implement, the excentrics are set on their shafts *d*, and *e*, so that the one pair of excentrics *e*, and *l*, shall have the "lead" of the next adjoining, and so on throughout the series, as is well understood. By this means the picks or diggers will follow each other in their action upon the soil, as represented in the figure, wherein it will also be seen that while the excentrics *e*, are severally giving their full strokes and forcing the picks or diggers into the ground, the corresponding excentrics on the shaft *d*, are making their outward throw; whereby the picks or diggers are drawn through the soil and out of it, at the same time lifting or displacing the soil on which they have been brought to act.

The patentee claims, "the arrangement of parts, herein described, for operating a series of picks or diggers."

To William Edward Newton, *of* 66 *Chancery-lane, for improvements in the joints or chairs of the permanent way of railways,—being a communication.*—[Dated 24th February, 1862.]

The object of the present invention is to strengthen and unite the ends of the rails of railways, where they meet, by a simple and cheap means, that will be efficient and will prevent or lessen the jarring or pounding of the passing wheels, which is so destructive to the rails or their joints.

The present invention consists in shrinking the iron chair to the rails at their joint, and thus preserving the whole surface bearing of the chair and rails, and making an extremely solid and firm joint, without the necessity for keys or wedges for holding the rails and chairs together.

The figure in Plate VIII. represents, in perspective, portions of two rails forming a joint, with a chair placed under the joint. One of the

rails *a*, having been laid, in any of the usual well known ways, and fastened to the sills, a chair *b*, is heated and driven on to its ends: a second rail *c*, is then driven into the chair *b*, or the chair may have been driven far enough into the rail *a*, so that the end of the rail *c*, may be laid up close to that of the rail *a*, and then the chair *b*, be driven back over the end of the rail *c*; and when the chair cools, it will shrink up tight to the rails, holding them with a firmness second only to that of welding. A gauge plate may be inserted at the joints, to keep the rails from close contact, and to provide for the expansion of the rails. A slip joint may be occasionally made to provide for the expansion and contraction of the rails. When double lines of rails are used, and the trains always run in the same direction, spikes or bolts may be used in connection with this joint, to prevent the rails from "creeping" under the force of the driving wheels of the locomotive.

As the jaws of the chair have less metal in them, and would not possess so much shrinkage as the other parts of the chair, and are more likely to spread than the other portions, a clamping tool may be used to press against the jaws whilst hot, and bring them tight up against the web of the rail; and thus almost the entire surface of the rail below its face or top may be in contact with the chair and hold it with great tenacity, making a very rigid joint.

The patentee claims, "the mode, herein set forth, of adapting chairs or supports to the joints or ends of railroad rails; particularly heating and shrinking the chair on to the joints, as described, so as to strengthen the same."

To Henry Bowen, *of Cardiff, for improvements in gas meters.*—[Dated 1st March, 1862.]

This invention relates to the system or mode of maintaining the proper water level in wet gas meters, by compensating for the evaporation or other loss of water in the boiler.

The figure in Plate VIII., is a longitudinal sectional elevation of the improved meter. *a*, is the inlet pipe; *b*, the valve box; *c*, the valve; *d*, the pipe which conveys the gas from the valve through the reservoir into the chamber of communication *k*, in which there is a spout or syphon pipe *e*, leading to the measuring drum: *f*, is the float; *g*, the stuffing-box pipe, which surrounds the upright spindle; *h*, the charge or overflow pipe, by which the interior of the meter is supplied with water; *i*, is the charge or feed pipe for supplying the reservoir or water tank *j*, with water; *l*, is the orifice, by which the supply of water from the tank passes into the drum chamber, to compensate for evaporation or alteration of the water level, caused by the pressure of the gas; *m*, is the receiver or waste water box; and *n*, the dip or discharge pipe. *o*, is the valve spindle, which passes through the float *f*; and at the lower end of the spindle there is a bridge piece with a weight *p*, attached, and which assists to bring down the valve *c*, to its seat, when the level of the water sinks in the reservoir *j*.

A cylindrical hole is made through the float, and inside this is a tube *r*, made gas tight at the top, by means of the screw *q*, which is attached under the valve seat; and *s*, is the measuring drum.

Upon water being supplied to the reservoir or chamber *j*, through the pipe *i*, it rises in this chamber until it flows over the open end of the vertical tube *h*, into the chamber of communication *k*, below, in which the water rises until it reaches the top of the pipe *e*, down which any excess will pass into the waste water chamber *m*, below. In the meantime, the chamber of the drum *s*, will be filled through the usual opening and the orifice or syphon pipe *l*, until it reaches the level of the pipe *e*. Gas may now be admitted to the meter through the pipe *a*, and valve *c*, and down the channel *d*, into the chamber of communication *k*, and from thence down the pipe *e*, into the drum chamber *s*, where it will be measured in the usual way. Now, supposing the proper level of the water in the drum chamber and chamber *k*, to be that indicated by the dotted lines, it will be evident that upon loss of water, from evaporation or otherwise, taking place in the drum chamber and chamber *k*, such loss will be compensated for from the reservoir *j*, through the orifice or syphon pipe *l*; a bubble or two of gas being allowed, by the unseating of the lower end of the pipe *h*, to pass up the pipe from the chamber *k*, to the reservoir *j*.

The patentee claims, "First,—the general construction and arrangements of parts forming a compensating wet gas meter, having a square frame and two chambers, as hereinbefore described; particularly the arrangement and mode of constructing and adapting the valve box and fountain; and also the conveying the gas from the valve box direct to the chamber of communication, as shown. The mode of constructing the float and adapting it to the valve. The mode, herein set forth, of compensating for loss of water in wet gas meters, by evaporation or otherwise, by means of a fountain or chamber. And, lastly, attaching the overflow pipe to the stuffing-box pipe, which admits air or gas into the fountain, for the purpose herein set forth."

To WILLIAM EDWARD NEWTON, *of* 66 *Chancery-lane, for an improved process and apparatus for reducing wood, straw, and other vegetable substances to pulp for the manufacture of paper,—being a communication.*—[Dated 5th March, 1862.]

THIS invention consists in disintegrating wood and other fibre-yielding vegetable substances, for the production of paper stock, by subjecting such substances to the mechanical operation of breaking, beating, or grinding, while it is immersed in and under the chemical influence of highly heated water, and under the pressure due to such high temperature.

The water, at a high temperature, has the effect of so softening and dissolving the cementing and other foreign substances which unite and adhere to the fibres, that the mechanical action to which the substances are subjected, while in that condition, effects a rapid separation of the fibres from each other and from all other substances, so that they can be readily reduced to paper stock of a good quality.

The figure in Plate VIII. is a horizontal section of an apparatus suitable for working the improved process. *a*, is a vessel, in which the fragments of wood, straw, or other fibre-yielding vegetable substances are to be operated upon. This vessel is capable of sustaining a pressure of from 60 to 80 pounds, more or less, to the square inch. It is made in the form of an endless bent tube, the form not being material, so long as it will admit of the free circulation of the material under treatment.

At *b*, this vessel is provided with a nozzle, whereby it may be connected with a boiler suitable for heating water to a temperature corresponding with a steam pressure ranging from about sixty to eighty pounds to the square inch, so that the water within this vessel may be maintained at about the range of temperature due to such pressure. *c*, is another nozzle near the bottom of the vessel, and to which a suitable pipe with a stop-cock is to be attached. This pipe leads to a suitable receptacle for receiving the stock after it has been prepared. The vessel is provided at *d*, with another nozzle, for discharging the dissolved cementing and other foreign matter. This, like the other nozzles, is to be provided with a suitable stop-cock under the control of the attendant. It is also provided on the inside with a diaphragm of wire gauze, to prevent the passage of the fibres when separated and reduced. The material to be treated is introduced through a large aperture at the top, covered with a cap plate *e*, which must be well secured when in place.

In one part of the circuit of this vessel there is a shaft *f*, which passes through a stuffing box *g*, to the outside, where it is provided with a pulley *h*, for receiving a belt from any suitable motor. This shaft is sustained within the vessel by a cross bar *i*, in which it has a bearing, and on each side of this cross bar it carries oblique vanes *j*, *j*, which, by their rotation, impart the required circulation to the water and substances under treatment in the vessel. On the other side of the vessel there is another shaft *k*, both ends of which pass through stuffing boxes *m*, m^1; one end, beyond the stuffing box *m*, being provided with a wheel *o*, to receive a belt from some suitable motor. This shaft passes through, and carries two sleeves *p*, p^1, each passing out through one of the stuffing boxes, as represented, and both being feathered to the shaft *k*, so as to turn with it. And for the adjustment of the grinding and beating surfaces, to be presently described, each sleeve is connected with its appropriate end of the shaft *k*, by a screw coupling nut *q*, q^1, and screw; so that by turning these coupling nuts, the sleeves, or either of them, can be adjusted longitudinally on the shaft *k*. On the sleeve *p*, there are secured arms *r*, with teeth on their edges, which correspond with teeth on the surface of stationary arms *s*, secured to and within the vessel. As the water and substances under treatment circulate in the vessel, in the direction of the arrow, they are acted upon and broken between the teeth on the rotating arms *r*, and the stationary arms *s*, and thence are carried along into a stationary female nut *t*, made in the form of a frustrum of a cone, and secured to the inside of the vessel. The inner face of this nut is formed with breakers or blades, such as are used in paper engines. And within this nut, and secured to and turning with the sleeve *p*, there is a male nut *u*, of corresponding form, whose periphery is armed with corresponding breakers or blades. The blades on these two conical surfaces still further reduce the substances under treatment, which then pass through the central eye of the nut *t*, to the surface of a semi-spherical nut or grinder *v*, attached to and turning with the end of the sleeve p^1. This grinder *v*, works within a corresponding cap-formed female nut *w*, secured to and within the vessel, the surfaces of the nuts *u*, and *v*, being armed with blades somewhat like those on the cylinder of the well-known paper pulp machine.

As both sleeves are adjustable, by turning the coupling nuts *q*, and q^1, the surfaces of the rotating nuts or grinders are caused gradually to approach the surface of the stationary female nuts, so that the substances

under treatment are gradually reduced mechanically, as the softening and dissolving effect of the highly-heated water on the cementing media progresses, until, finally, the whole of the fibre is reduced to a suitable condition for making paper.

As the process progresses, the cock or valve at *d*, is to be opened occasionally, to discharge the soluble matter which has been dissolved by the action of the water at a high temperature; the previous diaphragm preventing the escape of fibres. The operator can readily judge, by the escape of comparatively pure water, when all the foreign matter, separable by water, has been removed from the fibres.

The patentee claims, "the mode, herein described of disintegrating wood and other fibre-yielding vegetable substances, for the manufacture of paper stock; particularly subjecting such substances to the mechanical operation of breaking, beating, or grinding, or either, while it is under the chemical influence of highly-heated water under pressure, substantially as herein described. Also the apparatus shown, or any mere modification thereof, for effecting the disintegration of the fibres in the process above set forth."

Scientific Notices.

INSTITUTION OF MECHANICAL ENGINEERS.

April 24th, 1862.

A. B. COCHRANE, Esq., Vice-President, in the Chair.

The first paper read was, "*On the construction of lighting apparatus for lighthouses*," by Mr. Armand Masselin, of Birmingham.

The construction and illumination of lighthouses constitute one of the most important of public undertakings at the present day. The development however of the comparative perfection now attained in these two departments has been gradual and unequal. During the century that has elapsed since the erection by Smeaton of the Eddystone lighthouse, when engineering was greatly in advance of practical optics, the art of building towers has received few improvements, while the apparatus for illuminating them has, by the introduction of the dioptric system, acquired a striking degree of excellence. During nearly the whole of the last century, and in some places as late as 1816, open coal fires, improved occasionally by a flat brass plate, placed on the land side, were the rude means usually resorted to for producing light. The Eddystone tower had a lantern to protect the weak light given out by the few miserable tallow candles which were then used, and only in 1807 were these replaced by lights furnished with silver-plated parabolic reflectors. Distinction of one light from another, by its appearance at night, a point nearly as important as the range of the light, was, of course, out of the question.

Lights on the catoptric or reflecting system, composed of silver-plated parabolic reflectors, provided with plain cylindrical burners placed in the focus of each, were used exclusively until 1822, when Augustin Fresnel invented and erected on the Cordovan tower his first dioptric or refracting light. The catoptric or reflecting system was, in comparison with the imperfect means previously available, a valuable improvement, and, under later modifications, is still in extensive use in this country; but having many serious imperfections, it is gradually disappearing before the dioptric or refracting system.

The latest optical and mechanical improvements in the dioptric system are illustrated by the fixed light of the Smalls Rock, near Milford Haven, and the revolving light of Lundy Island, both constructed by Messrs. Chance, and the latter—attested by mariners as the most powerful light in Great Britain—flashing over thirty-five miles of the Atlantic. In the present paper it is intended only to notice briefly the existing state of reflecting and refracting apparatus and the relative merits of each, before giving the particulars of their mechanical construction.

In the dioptric or refracting system, only one lamp is used, placed in the vertical axis of the apparatus. In fixed lights, the middle or dioptric part having the lamp in its centre, is cylindrical, and composed of a series of refracting rings or lenses, which are so shaped as to give a horizontal direction to all the rays of light that fall from the lamp upon their inner faces. All the rays of light passing above and below these middle lenses are received by upper and lower catadioptric prisms, by which they are also transmitted horizontally after refraction and total reflection in the prisms. Every piece of glass in the apparatus forms a portion of a horizontal ring or belt, having its centre in the vertical axis of the apparatus. The rays of light given out by the lamp are thus collected and transmitted equally over the horizon, and the light is rendered luminous throughout its entire height. The glass prisms are fixed in eight gun-metal standards, forming an octagonal frame, each prism being supported in the centre by passing through an intermediate standard.

In revolving lights, the transverse section of the refracting lenses and prisms is precisely the same as in fixed lights: but, in revolving lights, the rings of glass are concentric round a horizontal axis, passing through the brightest part of the flame, instead of round the vertical axis. The circumference is divided into eight flat faces, each composed of a series of prismatic rings and segments having one common focus: the light emanating from the lamp is thus transmitted by each face in a brilliant flash extending over the whole width and height of the face; and the whole apparatus being made to revolve by clockwork, every point of the horizon is illuminated by a succession of brilliant flashes corresponding to the several faces, and at intervals of time determined by the speed of revolution. By the use of fixed and revolving lights, or combinations of them in various ways, lights of distinct appearance are produced in a number sufficient for all purposes that are required in practice.

Dioptric lights are made of six different sizes or "orders," as they are termed; and the following table gives the internal radius of the apparatus or the focal distance in each order, the number of wicks in

the lamp, and the consumption of oil in lbs. per hour, and in gallons per year, assuming the light to burn 11 hours per night, on an average, throughout the year.

Orders of Dioptric Lights.

Order.	Internal radius of Light.	Number of Wicks.	Consumption of Oil.	
			Lbs. per hour.	Gallons per year.
	Inches.		Lbs.	Gallons.
First	36·22	4	1·65	736
Second	27·55	3	1·10	490
Third	19·68	2	0·41	130
Fourth	9·84	2	0·26	116
Fifth	7·28	1	0 17	76
Sixth	5·90	1	0·17	76

The three largest orders are generally termed sea lights, and the three smaller ones harbour lights. The first order, as the most important, will alone be referred to in this paper, the others differing merely in size and number of prisms and lenses.

In the catoptric, or reflecting system, a number of parabolic reflectors are used, ranged round a framework, according to the purpose required, with a lamp in the focus of each reflector. In a fixed light, these reflectors, frequently as many as 24 or 30 in number, are arranged round the frame, so as to equalize the light as much as possible in all directions. In revolving lights, the reflectors are mounted on a revolving frame, having generally three faces, each of which carries an equal number of reflectors. Three flashes of light are thus produced, which illuminate successively every point of the horizon at intervals regulated by the speed of revolution. The loss of light in this system is necessarily very large: indeed, nearly the whole of the light from the front of the flame is directly lost by natural divergence, the reflectors transmitting to the horizon only the rays emanating from the back of the flame; and of this light nearly 50 per cent. is lost by the absorption that always takes place in reflection by metallic surfaces.

Comparing the two systems together, it is evident that for fixed lights no possible combination of reflectors can distribute a zone of light of equal intensity round the horizon, whilst this effect is completely obtained by the dioptric system. It is found that whilst only 3½ per cent. of a plain open light would be available round the entire horizon, 17 per cent. is obtained by the use of the best reflectors, but 83 per cent. is obtained by the use of the dioptric lights. The extreme divergence of the rays of light from a usual 21-inch reflector, with a 1-inch flame, is about 14 degrees; but the variation of the intensity of the flash emitted over this angle is very large indeed, the intensity of the light being only 16 per cent. on the sides of what it is in the axis of the flash, showing how great is the irregularity of the light spread over the horizon. Also the numerous fastenings of the reflectors and lamps frequently get loosened, increasing greatly the irregularity of the light. Nor is the whole amount of divergence, taken vertically, useful; for, as will be shown afterwards, the lower portion of the vertical divergence required to illuminate the sea between the horizon and the land

is but a very small amount. In uniformity of light, therefore, throughout the horizon illuminated, the dioptric system is very greatly superior to the reflecting for fixed lights. With regard to economy of oil, fifteen reflector lamps together consume as much oil as the one central lamp in the dioptric light, and the saving therefore amounts to 50 per cent. in favour of the latter, compared with a reflecting light of the largest practicable size, having thirty lamps, but greatly inferior in illuminating power to the dioptric light.

Another very important consideration is the durability of the apparatus. The longest time that reflectors will last, even when treated with the greatest care, is from 25 to 30 years; their thin silver coating will have completely disappeared at the end of that time. With moderate care and no necessity for re-adjustment, dioptric lights may be considered as imperishable: the lenses and prisms never lose their correct form and first polish, never require renewal, and are kept always equally efficient with a far less amount of daily labour than that required for reflectors. The number of attendants or keepers required is the same in both cases, and the first outlay may be considered as generally equal.

For revolving lights, however, the catoptric system presents fewer points of inferiority as compared with the dioptric: for, by sufficiently increasing the number of lamps and reflectors on each face of the revolving frame, a light of equal intensity to the dioptric might be produced. The illuminating power, consumption of oil, durability, and original outlay, will therefore be the chief considerations to determine the relative advantages of the two systems for revolving lights. The effect of only one of the eight faces composed of annular lenses in a first order dioptric light is equal to that of eight of the largest reflectors in use, 21 inches in diameter; and, consequently, to produce by reflectors the effect of the best dioptric light, a lantern would have to be provided capable of accommodating from 56 to 72 reflectors, an arrangement all but impracticable. Moreover, at the time when most of the experiments were made both in this country and abroad, for comparing the intensity of revolving dioptric and reflecting lights, the dioptric lights were composed merely of the central or singly refracting part. But in the present holophotal system, in which the upper and lower reflecting prisms are made to continue and extend the action of the central refracting lenses, as already described, the intensity of the dioptric lights has been nearly doubled, and the comparison rendered so much more unfavourable to the reflecting system.

The only objection which has been seriously urged against the dioptric system is the use of only a single central lamp, on account of any difficulty in its management affecting the whole light, or danger of its sudden extinction. This is met, however, by the successful experience of forty years with an immense number of lights in different parts of the world. Hardly ever has such a case occurred; and as spare burners are invariably supplied, and required to be always kept ready for use, a few minutes only would suffice to remove the defective burner and replace it by another.

The lamp necessarily forms a very important part of the lighthouse apparatus, in the efficiency of which it is an essential

element. The lamps generally used in the larger dioptric lights are of the class known as mechanical lamps, in which the oil is forced from a reservoir into the burner by means of a pump, worked by clockwork, driven by a weight. Although this construction of lamp is simple enough, it requires that the keepers should be trained to its use, and should have a thorough knowledge of the way of taking it to pieces for cleaning, and then putting it together again, before they are sent to their respective lighthouses. As this precaution was not at first universally adopted in lighthouses, complaints were made against the mechanical lamp; and, in consequence, lamps of the simplest possible construction, but inefficient in action, came into use in this country, consisting simply of a side reservoir, communicating by a tube with the burner, the level of oil in both being the same. The consequent absence of overflow prevented a high flame from being obtained and greatly impaired the efficiency of the light, which doubtless considerably retarded the adoption of the dioptric system. Pressure lamps were also made more lately, consisting of a large cylindrical oil reservoir containing a piston fitted with a cupped-leather packing, the pressure being obtained by a number of small weights arranged round the piston; whereby the oil was forced through the side tube into the burner. These lamps, however, presented many inconveniences: the pressure could not conveniently be varied, since the addition of one weight tended to cant the piston out of its horizontal position, and allow the oil to escape at the opposite side. The cylinder being made only of sheet brass, and, therefore, not perfectly cylindrical, a considerable difference of diameter between the piston and cylinder was required; and when the oil became rather warm, the leather got so soft that it was liable to turn over and render the lamp useless. The piston being entirely submerged, lost a portion of its weight; and whenever the pressure had to be varied, the weights taken out were covered with oil, and there was a great waste by the oil being spilled: there was also a liability to leakage, from the body of the lamp being made of several parts soldered together.

The conditions the lamps are required to fulfil are:—a constant and even supply of oil to the burner, equal to fully four times the consumption; simplicity of construction, so that any unskilled mechanic can take the lamp to pieces and put it together again; freedom from liability to derangement; and an accurate fit of the various parts, so that all duplicate parts will fit equally well.

To meet these requirements the writer designed a construction of lamp, which has fully answered the purpose. A brass cylinder, containing the oil for the lamp, is cast solid in one piece with the bottom, and bored out truly cylindrical, and is fitted with a turned piston, having a cupped leather packing; the three piston rods are connected at top to a wrought-iron ring, to which are attached the side rods passing down outside the cylinder to the wrought-iron ring below, which carries a weight. The piston is steadied against any small lateral oscillation by six leather guides, fixed round its circumference; and any air underneath is let out through a central vent cock. The oil is forced out at the bottom of the cylinder through an upright tube leading to the burner, the quantity being accurately adjusted by

a conical regulating valve, having an index on the screwed handle, which shows the quantity of oil supplied to the burner per minute or per hour. When the piston has descended to the bottom of the cylinder, it is wound up again by a rack and pinion underneath the cylinder; and the oil is prevented from being drawn down from the burner by a check valve, consisting of a small ball, situate in the feed pipe. The burner remains therefore constantly fully supplied with oil; and the time occupied by winding up the weight being only a few seconds, the overflow of oil is not even visibly affected. As impurities from the charring of the wicks, and especially a quantity of flue or dust from the cotton wicks, are constantly brought into the cylinder by the overflow oil, and afterwards drawn under the piston, these would find their way up through the feed tube into the burner, which would cause a stoppage of the supply of oil to the wicks. To prevent this, a fine wire sieve, placed in a box in the feed tube, arrests any impurities in the oil. Should the sieve get stopped up while the lamp is burning, it can be changed in less than a minute. Each wick is provided with two oil tubes, whereby a constant supply of oil to each wick is obtained, instead of all the wicks being fed by a single exterior tube, as in the previous lamps.

In order to produce a proper illumination of the horizon by this light, it is essential that the full height of flame should be kept up, maintaining the flame correctly in the focus of the apparatus, without which the best optical apparatus would be inperfect in action. For this purpose the overflow of oil must never be less than three or four times the actual consumption; otherwise, the wicks will burn down to the edge of the burner, and the intense heat produced would very soon destroy the burner itself. Moreover, when the supply of oil is too small, the heat of the flame has time to act on the small overflow, and considerably deteriorates the quality of the oil; and the overflow being all returned into the reservoir, the quantity of deteriorated oil in the reservoir increases until it is impossible to maintain a good flame.

The proper shape, diameter, and position of the shoulder or contraction, in the glass chimney used for the lamp, is of special importance, since this has a direct influence upon the shape and height of the flame, and, consequently, upon the intensity of the light produced. An adjustable damper is placed over the glass; and above this a continuous pipe, of about six feet in length, from the burner, is required to produce a sufficiently rapid draught to support the combustion. When the lamp is lighted at first, the wicks are kept low for some time, and gradually made to rise for about twenty minutes, until they rise about ½ inch to ⅝ inch above the burner; then, by a slight adjustment of the wicks, to obtain equal height of flame, and the occasional shutting or opening of the damper, a most intensely bright and high flame is obtained and kept up during the whole of the night. The diameter of the burner and flame of a first order lamp is 3½ inches, and, with proper management, the flame is kept up constantly to a nearly uniform height of 4 inches.

The oil used in lamps for lighthouses is the refined colza oil or rapeseed oil, which is the only oil fit for the purpose, and is much superior to the sperm oil formerly used, and is also cheaper. It burns with a

brighter flame, and does not cause so much deposit on the wicks, which therefore burn much longer without requiring to be trimmed. It also requires far more intense cold to thicken it than other oils, and there is therefore much less need of the small auxiliary frost lamp used in frosty weather for warming the oil in the main lamp. The thickness of the wicks is another point to be attended to, as a thin wick gives a brighter flame than a thick one under the same circumstances. When a lamp is in proper position, supplied with proper materials, and in the hands of a moderately careful attendant, the flame can be kept up, for fully seventeen hours, to its full size, untouched, without requiring to have the wicks trimmed. The quantity of oil consumed in a dioptric light during a given period, is thus, to a certain extent, a test of the efficiency of the light, as it indicates the height of flame kept up during the time.

For producing the revolution in revolving lights, the optical apparatus is carried by a revolving platform, which is mounted on a large cast-iron pedestal that receives the clockwork for producing the revolving motion. This platform is carried on gun-metal rollers, centred on a live roller frame, running round a fixed centre shaft on the top of the pedestal. The roller paths on the top of the pedestal and the under side of the revolving platform are of steel; and the rollers are fitted on their spindles with washers of different thickness, to allow of slightly varying their positions from time to time, in order to avoid grooving the paths, by running constantly in one line. The driving motion is communicated from the clockwork by a pinion gearing into an internal toothed wheel on the under side of the platform. The clockwork is driven by a heavy weight, and the speed is regulated by a pair of flies on the fly wheel, which are adjusted to the proper angle for controlling the motion to the required speed. The whole of this improved arrangement of clockwork and pedestal was devised by Messrs. Stevenson, of Edinburgh, for the service of the Northern Lights, where its constant use for many years has proved its great superiority over the arrangements adopted in all other revolving lights.

The optical apparatus itself is of an octagonal shape, and the frame is constructed entirely of gun metal. The catadioptric prisms, composing the upper and lower portions of the light, are fixed in the eight gun-metal standards of the frame; but the lenses forming the central portion are carried in separate frames, bolted to the standards, with a slight clearance left at the top, to prevent the risk of any weight coming on the rings of glass forming the lenses, which, being in close contact with one another, would give way under the least pressure. At the bottom the prisms are omitted in one side, to allow of access to the lamp, which is erected upon a stand on the service table. A copper ventilating tube extends up above the lamp into the neck of the cowl, on the plan introduced into the lighthouse service by Professor Faraday. Inverted funnels are placed at different levels in the ventilating tube, to afford a free escape to any accidental downward gust of wind, and thus prevent any risk of the lamp being blown out. The draught of the heated air in the tube also draws off, through the funnels, a quantity of the air of the light room; thereby preventing condensation of the moist air upon the glazing of the room, which would otherwise interfere

greatly with the efficiency of the light. A short length of the tube at the bottom, containing the damper, is made to slide upwards, to allow of removing the glass chimney, but so as not to weigh on the glass or fall when the glass is taken out.

The lantern, within which the whole of the lighting apparatus is contained, is of an octagonal shape. It is 13 feet in diameter, and formed of cast-iron panels, with the joints planed to the proper bevil, so as to fit solid together. The standards supporting the dome of the lantern, and forming the framing of the plate-glass panes, are of wrought iron, and inclined alternately right and left, which adds greatly to the stiffness of the structure; while the light is not entirely intercepted in any vertical plane, as would be the case if the standards were vertical. To prevent corrosion by the action of the sea air, the standards are protected along the outer edge with a gun-metal facing, grooved to receive the plate-glass panes, which are then secured in their places by thin covering strips of gun-metal screwed on outside.

The glazing of the lantern consists of panes of plate glass about $\frac{3}{8}$ inch thick, the edges of which are ground, and the arises bevilled, to prevent breakage in fixing, or in any possible shaking of the lantern in a violent gale. Small strips of lead are placed between the glass and the gun-metal frames, and the interstices are filled up with putty. The glass lies entirely within gun-metal frames, and there is no difficulty in replacing a broken pane at any time. To guard against an accidental stoppage of the light, through breakage of a pane in a gale, or by sea birds flying against the glass, storm panes are provided, made of a copper frame glazed with thick glass, which are kept always ready in the light-room, and can be fixed in a few minutes in place of a broken pane. A copper dome forms the roof of the lantern: it is made double, with an air space between; and the cowl, at its summit, revolves with the weathercock, to turn the openings always from the wind, allowing a free escape for the heated air from the ventilating tube of the lamp.

The efficiency of a dioptric light depends entirely upon the proper adjustment of the various optical elements which compose it. The vertical divergence of the rays of light depends on the dimensions of the flame of the lamp, and seldom exceeds an angle of 5 degrees, which is amply sufficient for all practical purposes. For an angle of vertical divergence, equal to one-fourth of the dip of the horizon, illuminates half the whole distance from the horizon to the lighthouse; and an angle of vertical divergence equal to the dip of the horizon, illuminates three-fourths of that distance. Within a mile or two from the lighthouse, however, an angle of vertical divergence equal to the dip of the horizon, illuminates only a small fraction of a mile, showing how little is gained by increasing the vertical divergence at the sacrifice of brilliancy at the horizon. Thus, for a tower of 100 feet height, about $\frac{1}{6}$th of a degree (9′ 45″) is the amount of the dip of the horizon, and a further angle of the same amount illuminates the sea from the horizon towards the land for a length of $8\frac{1}{2}$ nautical miles, the total range of the light being in this case $11\frac{3}{5}$ miles. For a tower of 200 feet height, the dip is about $\frac{1}{4}$th of a degree (13′ 46″), and a further angle of the same amount illuminates from the horizon a distance of 12 miles out of a range of 16 miles. These figures show that a vertical diver-

gence equal to the dip of the horizon is quite sufficient to illuminate the sea from the horizon up to within a moderate range of the tower.

The efficiency of the light depends also upon its being correctly adapted in direction and divergence to the particular elevation it is intended to occupy, otherwise a portion of the brighest rays may pass above the horizon, and consequently be lost, instead of being of service at and within the horizon. The dioptric system also affords peculiar facility for directing the light upon any particular point where it is more especially required. For instance, a light may be required merely as a sea light, for the purpose of signalling to mariners their approach to the land: in that case, the most intense light of the whole apparatus is directed towards the horizon. Or a light may be required to illuminate the horizon, but most particularly the sea in the neighbourhood of the land, the approaches of a harbour, or some particular local danger: in that case, the light of some portions of the apparatus is directed towards the horizon, and the light of the other portions is deflected towards the point requiring special illumination.

A specimen of one face of the optical apparatus, containing the lenses and prisms of a revolving light, was exhibited from Messrs. Chance's glass works, and also a specimen of the pressure lamp used for the most powerful lights.

The Chairman enquired what were the particular difficulties with the mechanical lamps formerly used in lighthouses, in which the oil was raised by pumps driven by clockwork.

Mr. Masselin replied, that the old mechanical lamps were complicated in construction, and the clockwork for working the oil pumps had to be got into a confined space, being more like watchwork than clockwork, and requiring a skilled mechanic, properly trained, to manage it; and as lighthouses were generally situated at a distance from any town, it was a serious objection to have any liability of requiring to send away to get the necessary repairs done. The pressure lamps now used were of simple construction and stronger in all the parts, as shown by the specimen exhibited; they had no machinery about them requiring attention, and there was therefore no liability of the light ever failing from the lamp getting out of order. Of course, clockwork was still required for making the lights revolve, but this was so much stronger and larger, that it was not liable to get out of order, and admitted of easy repair.

The Chairman asked whether the wicks in the lamp were all used at the same level, and what height of wick was required above the burner.

Mr. Masselin said each wick was raised independently of the rest by a separate screw, and they were all turned up to exactly the same level, standing about $\frac{3}{8}$ inch above the burner, of which about $\frac{1}{4}$ inch became blackened by the flame, leaving $\frac{1}{8}$ inch steeped in the overflow of oil standing above the burner. He showed that the entire burner, together with the glass chimney, was readily removed by simply unfastening two screws, and it could then be immediately replaced by a fresh burner, which was kept always ready at hand in the light-room. The light was now kept up with such regularity that the wicks did not require any alteration during the whole night, after having been once adjusted to the proper level for producing a brilliant flame.

In reply to an enquiry of the Chairman, as to what distance the dioptric lights were visible, and whether the whole of the light was confined in the vertical direction within so narrow a limit as only 5 degrees of divergence, Mr. Masselin said, that the range of the light depended on the height of the lighthouse and consequent distance of the horizon: at Lundy Island in the Bristol Channel, where the lantern was about 540 feet above the sea, the horizon was about 35 miles distant, and the light was distinctly seen at that distance. The power of the light at such at a distance depended of course upon the concentration of the greatest possible amount of the rays within a very small angle, and the angle of 5 degrees was the maximum amount of vertical divergence in most cases. The extreme minuteness therefore of the angles to be dealt with rendered perfect accuracy of workmanship and adjustment in the optical apparatus of the utmost importance. The middle ray or axis of the light did not issue in a true dead level, but was deflected to the horizon, being depressed by the amount of the dip of the horizon, so as to throw the strongest part of the light full upon the horizon; and of the $2\frac{1}{2}$ degrees or 150 minutes forming the lower half of the divergence, the first 10 minutes alone were sufficient to light three-quarters of the distance from the horizon towards the lighthouse, in the case of a tower 100 feet high. If more of the light was wanted on the sea and less on the horizon, the axis was further deflected, so that the central rays fell on the sea nearer in than the horizon.

Mr. Masselin believed it was only in England and the English colonies that there were any lights remaining on the old reflecting system, as they had been entirely abandoned in other countries for dioptric lights, and in this country the present reflecting lights would no doubt be replaced by dioptric apparatus, as soon as the reflectors required renewal. He did not know what was the greatest distance illuminated by a reflecting light, but with a sufficient number of lamps and large reflectors, there was no reason why as good a light should not be obtained by the reflecting system, for revolving lights, as by the dioptric: but the cost of maintenance and consumption of oil was much greater in the reflecting system, and the whole of the reflectors required entirely renewing after a certain time of wear. The largest reflectors that he knew of were 21 inches in diameter, and the greatest number employed in any one light was from 24 to 30.

Mr. Sampson Lloyd thought the paper that had been read was of great value and general interest, on account of the high degree of perfection attained in the apparatus, and also from the number of wrecks still occurring and the importance of efficient lighthouses for preventing them. He enquired what increase had taken place in the number of lighthouses since the introduction of the improved system of lighting, and how many dioptric lights there now were round the coast of England.

Mr. Masselin replied that eighty years ago there were no lighthouses deserving of the name, but only a few towers with coal fires to serve as beacons; and even as late as 1820, several of the main lights, at Harwich and elsewhere, were only open coal fires with a brass plate placed behind as a rude kind of reflector. The celebrated Eddystone lighthouse was originally lighted by only a few miserable tallow candles, and in 1780 the first reflectors were used; but these were made only of

plaster of Paris, hollowed to a parabolic shape, having the inner face covered over with small pieces of ordinary mirror glass set in the plaster, which were replaced in 1807 by copper reflectors silvered on the face. The old reflecting system continued in general use until 1834, when Fresnel's more perfect dioptric light was introduced into this country, the first being erected on Lundy Island. The optical apparatus then consisted of only the annular lenses forming the central portion through which the light was simply refracted, without any of the catadioptric or totally reflecting prisms by which the light was now rendered luminous throughout the entire height of the apparatus. The number of lights now in use round the coast of England was altogether about 200, of which only about 38 were dioptric lights; but in the United States there were already more than 500 dioptric lights.

The following paper, "*On the coal and iron mining of South Yorkshire*," by Mr. Parkin Jeffcock, of Derby, was next read.

In this paper the author considers the general features of the South Yorkshire district with reference to the circumstances affecting mining engineering.

The South Yorkshire district extends from Sheffield on the south to Wakefield on the north about 25 miles, and from west to east about 20 miles altogether, on either side of Barnsley. The general extent of the coalfield was illustrated by a map showing the outcrops of two of the principal seams of coal, the Silkstone and the Parkgate seams; the positions of the principal faults; the localities of the more important colleries and ironworks; and the lines of railway and water conveyance. Horizontal and vertical sections of the district were also given.

The South Yorkshire coalfield is a continuation northwards of the Derbyshire coalfield. On the east it is bounded by the overlying and unconformable magnesian limestone and permian strata, and the extent of the coal measures in this direction is yet unproved. On the west the millstone grit rocks crop out, forming the bleak moors of North Derbyshire; and the coal measures extend northwards and constitute the North Yorkshire coalfield. The general dip of the coal strata is from west to east at an average angle of 1 in 9; this, however, is much modified in many localities by main faults. The total number of coal seams is very great, and many of them have been worked in various localities.

The following are the principal seams of coal in their geological order, with their average thickness:—

1.	Wath Wood or Muck seam	4 ft.	6 ins. thick.
2.	Coal, no name	3	8
3.	Woodmoor seam	3	0
4.	Winter seam	5	4
5.	Upper Beamshaw seam	4	8
6.	Lower Beamshaw seam	2	2
7.	Kent's Thin seam	2	7
8.	Kent's Thick or High Hazel seam	5	0
9.	Barnsley Thick seam ... ... 8 ft. 6 ins. to	9	0

10.	Swallow Wood seam	5	0
11.	Howard or Flockton seam	5	0
12.	Fenton's Thin seam	2	3
13.	Parkgate or Chapeltown seam	6	9
14.	Thorncliffe Thin seam	2	6
15.	Four Foot seam, variable	4	0
16.	Silkstone or Sheffield seam	5	0
17.	Charlton Brook or Mortomley seam...	3	0

The most important seam of the series is the Barnsley Thick coal, which, under the name of the Main or Top Hard coal, has been very extensively worked in Derbyshire. In the South Yorkshire district, its average thickness is about 8 feet 6 inches, but the thickness varies exceedingly at different places. It is most fully developed in the neighbourhood of Barnsley, but extends through the greater part of the district, and has been principally worked at Woolley, Gawber, The Oaks, Edmund's Main, Wombwell Main, Darley Main, Elsecar, Warren Vale, Rawmarsh, Hoyland, Lundhill, Mount Osborne, Thryburgh, Darfield, Car House, &c. The hard coal from this seam is in great repute for steam purposes, and stood high at the trials made at Woolwich in 1851, relative to the value of steam coals. North of Woolley the Barnsley seam is subdivided into two or three others, which are worked in the neighbourhood of Normanton under different names. In Derbyshire, it appears to the best advantage at the large works of Mr. Barrow, at Staveley, where is is known as the Staveley Hard coal, which has been extensively used for steam purposes, and in the manufacture of iron.

The Swallow Wood seam occurs about 60 yards below the Barnsley Thick coal, its thickness varying from 3 feet 4 inches to 6 feet. It has been worked only to a very limited extent, principally at Swallow Wood; and is known in Derbyshire as the Dunsil or Oldgreaves coal, lying there about 30 yards below the Top hard seam.

The Parkgate or Thorncliffe Thick seam occurs at an average depth of 219 yards below the Swallow Wood, and has been chiefly worked at Parkgate, Thorncliffe, Pilley, &c. Its average thickness is 5 feet 6 inches, but the thickness varies considerably from 4 feet 10 inches to about 6 feet. It is known as the Bottom Soft coal in Derbyshire, where it has been extensively worked.

The Thorncliffe Thin seam, called the Bottom Hard in Derbyshire, is found 24 yards below the preceding; its thickness is from 2 feet 6 inches to 3 feet, and it has been principally worked at Thorncliffe, Pilley, &c.

The Silkstone or Sheffield seam lies about 61 yards below the Thorncliffe Thin, and has an average thickness of about 5 feet. It is a very well defined seam, and may be taken as a sort of datum line in identifying the position of the other beds. It has been principally worked in the neighbourhood of Sheffield, and at Chapeltown, Thorncliffe, Pilley, Mortomley, and Silkstone; and is identical with the Blackshale or Clod coal of Derbyshire. The coal is of great value for house fire purposes,—competing with the celebrated Hetton Wallsend.

By far the most important and valuable of the seams of coal are the Barnsley Thick and Silkstone seams. At the Woolwich trials,

made by the admiralty in 1851, relative to the strength and value for steam purposes, of the Barnsley Thick coal from Darley Main, West Hartley coal from Newcastle, and Welsh coals from Merthyr Tydvil, the total weight of water evaporated in each case was 24,960 lbs., and the evaporation per lb. of coal was 8·10 lbs. by the Barnsley Thick and West Hartley coals, and 8·25 lbs. by the Merthyr coal. Trials were also made of the Barnsley Thick coal, in 1858, at Doncaster, on the Great Northern Railway, when the evaporation obtained was 7·64 lbs. of water per lb. of coal,—the total weight of water evaporated being 448,281 lbs., and the coal used being a mixture of steam coal and house fire coal, consumed under Cornish boilers, working at a pressure of 45 lbs. The Barnsley Thick coal lights easily, burns freely, and raises steam rapidly. It produces only a very small quantity of white ashes and cinders, giving little trouble to the stokers, and the less it is disturbed the better; it does not clog or adhere to the bars, and makes no slag, maintaining a good clear fire with little sulphur. It is a most economical coal for marine engines, and in using it a light thin fire is particularly recommended.

The mines of ironstone occur between the Barnsley Thick coal and the Silkstone coal. The first mine of importance is the Swallow Wood, about 60 yards below the Barnsley Thick coal, which has been principally worked at Milton, for the supply of the furnaces there. It consists of three measures of ironstone; and an analysis of a sample of the ore by Mr. Spiller, of the Geological Museum, gave 26·79 as the percentage of metallic iron.

The Lidgate mine, next below the Swallow Wood, has been extensively worked at Milton, Tankersley, and Thorncliffe.

The Tankersley mine is usually found about 50 yards below the Lidgate, and is called also the Musselband ironstone, from the number of fossil shells it contains. It has been worked chiefly at Tankersley, and yields about 1500 tons of ironstone per acre.

The Thorncliffe Black mine lies about 70 yards below the Tankersley: it is worked principally at Parkgate, and used in the furnaces at Milton and Elsecar; and an analysis by Mr. Spiller gave 34·16 per cent. of metallic iron.

The Thorncliff White mine lies immediately below the Parkgate seam of coal, and consists of three measures, containing about 32 per cent. of metallic iron, and yielding about 1500 tons of ore per acre. It has been worked principally at Parkgate and Thorncliffe, and was formerly worked extensively at the Holmes.

The lowest mine is the Clay Wood or Black mine, consisting of three measures, containing about 32 per cent. of iron, and yielding about 1600 tons of ore per acre. It has been got to a great extent at Thorncliffe, and is identical with the Black Shale or Stripe Rake of Derbyshire, which is so much prized by the ironmasters of that county.

The principal ironworks of the South Yorkshire district are at Parkgate, Holmes, Milton, Elsecar, and Thorncliffe, in blast; and at Chapeltown and Worsborough, out of blast.

The modes of working the coal in the South Yorkshire district may be considered as modifications of the "long wall" system, so extensively and successfully practised in the midland counties. The

"pillar and stall" mode of working, adopted in the north of England, has not been much used in South Yorkshire; and the "long wall" system being principally confined to the midland counties, the South Yorkshire system of working may be regarded as a combination of the two. Where the circumstances are favourable, the "long wall" system is being extended in the Yorkshire coalfield; and wherever it can be adopted, it is to be recommended on account of the simplicity of arrangement, both for working and ventilation, and also as being the most economical method of getting the coal.

The principal modes of working the coal adopted in Yorkshire are the "Narrow Work," "Long Work," "Bords and Long Work," "Wide Work," and "Bank Work;" which were illustrated by ideal diagrams, prepared by Mr. Charles Morton, the government inspector of mines for Yorkshire. They were represented by ideal plans, because no mode is carried out in its integrity at any collieries in the South Yorkshire district; in some instances one mode being adopted in one part of the workings, and another elsewhere in the same colliery. These different systems of working, some of which, however, are falling into disuse, have been rendered necessary by the variable nature of the roofs and floors of the coal seams in the South Yorkshire district.

Various supports for the roof are used in the Yorkshire seams: wooden props or puncheons are adopted in some cases; in others piles of wooden blocks, called "chocks" or "clogs," and in others "packs" of rock and shale. Cast-iron puncheons also are now being extensively introduced as supports.

Two of the greatest difficulties that have to be contended with in mining are water and gas. With regard to water, the mines in the South Yorkshire district are not in general heavily watered in comparison with other mining districts; the workings nearer the outcrops or "bassets" of the seams are generally more watered than the rest. Except in some special instances, there are few collieries where large pumping engines are required: lift pumps are used exclusively, and even tubbing has scarcely ever been resorted to. A remarkable inundation occurred a year ago, at the Woolley Colliery at Darton, near Barnsley, which is working the Barnsley thick coal: the coal is drawn up a long inclined plane, extending from the outcrop of the Barnsley Thick seam, and following the dip of the seam; and the water is raised by means of flat pumps. On the 13th April, 1861, a sudden irruption of water into the workings took place to such an extent that they were almost entirely filled. The water entered through a fissure in the overlying rock, which is of considerable thickness, and is full of cracks and fissures towards its outcrop. It is probable that a large amount of head or drainage water had accumulated in these fissures while they remained closed, and that they afterwards became opened by subsidence of the strata, in consequence of the working of the coal: the water was found to be drawn away from a well in the rock at the surface 170 yards above the coal. The accumulation of water must have been very great, as it continued rising in the day drift a fortnight after the inundation had occurred, at the rate of more than one foot per hour, although a double 10-inch pump had been kept continuously at work; but its rise was subsequently stopped by additional pumping power.

In the amount of gas generated by the different seams of coal there are great variations. The most terrible explosions have taken place in the Barnsley Thick coal, especially at the Darley Main Colliery, the Oaks, Warren Vale, and Lundhill: the Barnsley Thick and Silkstone seams being specially liable to sudden and powerful emissions of gas. The ventilation is produced by a furnace at the bottom of the upcast shaft, by which a fresh current of air is kept continuously flowing through the mine, so that any gas issuing from the coal is speedily diluted and rendered harmless. For distributing the air through the workings, stoppings, doors, and regulators are arranged in proper places. The division of the air into separate "splits," each of which ventilates a distinct portion of the workings by means of the crossings or "overcasts," and "scale doors" or regulators, may be considered, if properly carried out, one of the best preventives of explosions in these very fiery South Yorkshire mines. All the return air should be conducted into the upcast shaft by a dumb drift, so as not to pass through the fire of the furnace; and the underground furnaces, whether closed or otherwise, should be fed with nothing but fresh air direct from the downcast shaft.

At some of the mines in the district, belonging to Earl Fitzwilliam, large fans, driven by steam power, have been substituted for the furnace generally used elsewhere; they are a simple and efficient means of mechanical ventilation, well worth the consideration of all interested in mining, and have now been continuously working with complete success for several years. In the early periods of mining, the only ventilation was natural ventilation, the current of air through the workings being produced simply by the colder and denser air from the downcast shaft displacing the hotter and rarer atmosphere of the mine. Sometimes rarefaction was increased by putting a pan of coals in the upcast shaft; but the consequence of such imperfect ventilation was that the workings were sometimes stopped for many days together. Natural ventilation could, of course, be adopted only when the shafts were of moderate depth and the workings on a limited scale.

The introduction of safety lamps into mines is of comparatively recent date. In the South Yorkshire district they were first used exclusively at the Oaks Colliery, in the workings of the Barnsley Thick coal, where Stephenson lamps are used in preference to Davy's; and the use of safety lamps has since extended to many other collieries. At the Wharncliffe Silkstone Colliery, near Barnsley, working the Silkstone seam, Stephenson and Davy lamps are used exclusively; and as the coalfield is very much cut up here with faults, the gas cannot be "bled" away, but as each fault is cut through, the greatest caution is required in dealing with the gas in the solid coal beyond, "in bye." In addition to the use of safety lamps, an abundance of air should be taken into the working places of fiery mines. Since the explosion at Lundhill, in 1857, safety lamps have been exclusively adopted there. The importance of their use in fiery workings was strongly shown at the Oaks Colliery in 1857, when an outburst of gas took place in the workings down the engine plane, so violent that it was compared to the roar of a draught in the furnace. All the Stephenson lamps were put out, and the

Davy lamps were ignited internally, the gauze becoming red-hot. As the outbursts of gas occurred within a hundred yards of the main intake to the upcast shaft, and a large quantity of air was passing this part at the time, the gas was soon diluted and carried away; and in less than an hour the only traces that remained were found at one or two places were the floor had been upheaved. Thus, no doubt, a terrible explosion had been averted by the use of safety lamps; but if any one of the lamps had been out of order, or the gauze smeared with oil or coal dust, or if any naked light had been in this part of the workings, an explosion would inevitably have occurred.

In conclusion, it was remarked, that the facilities already existing, by railway and canal communication, for the conveyance of the minerals raised in this district, to London and other markets, which in a few years will, no doubt, be considerably increased by the extension of the railway system,—and the central situation of the district in the great midland coalfield, the largest in England,—together with the extent to which it yet remains undeveloped,—combine to give the South Yorkshire district an important position among the mining districts of this country.

In reply to an enquiry of the Chairman, as to what were the principal differences in working the coal by the long wall system and by Yorkshire bank work, aud what was the proportionate increase of yield per acre in long wall working, Mr. Jeffcock said that in the Yorkshire bank work, a number of single "bords" (roads cut against the face of the coal, transversely to the grain) were driven following the rise of the coal; and at right angles to them a series of "endings" (roads driven lengthways of the grain, against the end of the coal) were cut into the intervening coal, which was then worked out, with the exception of a certain thickness left on each side of the bords to serve as pillars for supporting the roof over the bords, in order to keep them open for getting the coal out and maintaining the ventilation. The great difficulty in the bank work was in maintaining the ventilation properly up to the working faces while they were being pushed on into the solid coal beyond the last pair of endings opened, before the next ending was reached; because, at this time, the working face was out of the direct line of the current of ventilation, and the air could not be efficiently kept close up to the workings. There was also a great loss in the quantity of coal that had to be left in the mine in the pillars; and if these were afterwards got out in a second working, the cost of working them was very great, and the coal itself was so much crushed as to be greatly deteriorated in value. But in the long wall system now being adopted, all second workings to get out pillars was avoided, the whole of the coal being worked out at one operation. The yield of coal per acre was therefore much greater in the long wall mode of working, and its value was increased by the diminution in the quantity of small coal and slack produced by the working: there was also less expense in running the few long headings required in long wall working than in driving the great number of shorter ones required in bank work. Moreover, the working face was always in the line of the ventilation, without any blind recesses into which the air would not enter;

and the current of air passed along the entire face of the workings throughout its whole length.

Mr. W. Mathews enquired what was the comparative cost of getting the coal by these two modes of working.

Mr. Jeffcock replied that the cost of getting would be about the same at the working faces in each case; but the total cost, including "dead" charges, was greater in bank work than in long wall work, on account of the expense of driving so many more passages in the former plan.

Mr. J. E. Swindell remarked, that the larger amount of "dead" work on the roads in bank work must, of course, increase the cost of opening the mine; and the long wall system appeared much superior in requiring fewer roads for winning the coal. It was also less expensive to cut a few gate roads of large size than a great number of smaller roads. He asked what length of face was being worked on the long wall plan at the Wharncliffe Colliery.

Mr. Jeffcock said, the working face at that colliery was 400 yards in a continuous length, and the second face in the nearer portion of the workings was also the same length, but subdivided by a pillar bord into two lengths: the total length of face was therefore 800 yards working on the long wall system.

Mr. J. E. Swindell supposed there would be a limit to the length of face that could be worked on the long wall plan, depending upon the quantity of coal that could be conveniently brought down the main gate roads at one time. He enquired whether the coal from the whole of the 400 yards working face was got out into the main gate roads through a single opening at each end of the face, or whether intermediate gob roads or packed roads were maintained through the goaf for conveying the coals got from the middle portion of the working face. If packed roads had to be maintained for this purpose, it would diminish the superiority of the long wall system as compared with other modes of working, in respect of cost.

Mr. Jeffcock said, in opening a new face of work, the coal was brought out through the intermediate packed roads into the main gate road; but as the working face was carried further forwards, they were gradually abandoned and the roof allowed to fall in, their outer ends next the gate road being closed by stoppings, to preserve the ventilation. To save the expense of keeping these packed roads in repair, new top levels were driven in the solid coal at the distance beyond which the packed roads would not carry without greater expense; and the pillars were afterwards got out along the sides of the levels. At the Wharncliffe Colliery there were three main gate roads, worked as self-acting inclines, down which the whole of the coals from the two faces of work were brought to the winding shaft.

Provisional Protections Granted.

1862.

[*Cases in which a Full Specification has been deposited.*]

2298. Marc Antoine François Mennons, of Paris, for an improved apparatus for the production of sealing-wax impressions,—being a communication.—[*Dated August* 15*th.*]

2343. Charles Monson, of Connecticut, U.S.A., for a repeating rotary engine.

2345. Edward Samuel Ritchie, of Massachusetts, U.S.A., for an improvement in the mariner's compass.

The above bear date August 22nd.

2386. Marc Antoine François Mennons, of Paris, for improvements in smoke-consuming furnaces,—being a communication.

2387. Marc Antoine François Mennons, of Paris, for an improved assorting apparatus, applicable to the numbering of raw silks,—being a communication.

The above bear date August 28th.

[*Cases in which a Provisional Specification has been deposited.*]

1090. Thomas Wood Gray, of Fenchurch-street, for improvements in the manufacture of explosive compounds,—being a communication.—[*Dated April* 15*th.*]

1132. Samuel Rideal, of Manchester, and Robert Shepherd, of Great Grimsby, Lincolnshire, for improvements in railway brake apparatus.—[*Dated April* 17*th.*]

1153. Edward Henry Cradock Monckton, of Thurloe-place, South Kensington, for improvements in the preparation of metal to be used in the construction of cannon, rifles, armour plates, and other objects used in naval or military warfare, or otherwise.—[*Dated April* 21*st.*]

1167. Edward Henry Cradock Monckton, of Thurloe-place, South Kensington, for improvements in umbrellas, parasols, awnings, tents, and covering cloths, and in waterproofing the same.—[*Dated April* 22*nd.*]

1184. Alfred Hodgkinson, of Belfast, for a mixture of composition to be used in the process of boiling, preparing, or bleaching vegetable substances, whether they are in the manufactured or unmanufactured state, which mixture may also be used in the manufacture of soap.—[*Dated April* 23*rd.*]

1278. Alexander Prince, of Charing-cross, for a new composition for casting to represent marble,—being a communication.—[*Dated April* 30*th.*]

1647. Ignazio Villa, of Denmark-street, Soho, for a new and improved method of exhibiting terrestrial and astronomical phenomena, and of facilitating the solution of problems relating thereto without the aid of calculation.—[*Dated May* 31*st.*]

1766. John Robinson, of Rochdale, for improvements in machinery or apparatus for sawing wood.—[*Dated June* 13*th.*]

1902. James Petrie, of Rochdale, for improvements in slide valves for steam-engines.—[*Dated June* 28*th.*]

2029. Alphonse Couvreux, of Paris, for an improved centrifugal apparatus for breaking stones.

2031. Alphonse Couvreux, of Paris, for an improved centrifugal apparatus for casting stones and other materials, and in forming embankments and other structures.

2032. Edward Draper and Edward Thomas, both of Birmingham, for a new or improved method of strengthening wooden shutters and doors.

The above bear date July 15th.

2051. Joseph Willcock, of Chancery-lane, for a new ornamental fabric and the machinery for producing the same,—being a communication.

2053. Frederick Luke Stott, of Rochdale, for improvements applicable to mechanism or apparatus for warping yarns or threads.

The above bear date July 18th.

2069. James William Green, of St. Paul's-buildings, for an improved method of cutting sheet and plate glass to any given design, giving the finished form the brightest polish possible,—being a communication.

2074. Andrew Naudain, of West Farms, Westchester, James Peacock, of Morrisania, Westchester, and William Henry Walton, of New York, for improvements in looms for weaving all kinds of textile fabrics.

2075. William Clark, of Chancery-lane, for an improved pomade or balsam,—being a communication.

The above bear date July 21st.

2083. Roderick Grogan, of Westbourne-gardens, Bayswater, for improvements in screw propellers of steam vessels, and in the arrangement thereof.—[*Dated July 22nd.*]

2093. Charles Joseph Keene, of Shrewsbury-villas, Bayswater, for a new or improved winding apparatus for raising and lowering canvas on easels.

2095. Edward Kenworthy Dutton, of Stretford, Lancashire, for certain improvements in steam-engines.

2097. William Clark, of Chancery-lane, for improvements in the manufacture of manure,—being a communication.

2099. Robert Bell, of Dublin, for improvements in the manufacture of bricks,—being a communication.

The above bear date July 23rd.

2101. James Dickson, of Tollington-road, Holloway, for improvements in treating copper ores and solutions of copper, to obtain copper therefrom.

2103. William Clissold, of Dudbridge, for an improved mode of manufacturing cylinders.

2105. Toussaint Lemaistre, of Paris, for improvements in privies.

2107. William Henry Perkin, of Sudbury, for improvements in printing and dyeing when aniline and analagous coal tar dyes are employed; also in preparing coloring matters,—being a communication.

2109. Michael Henry, of Fleet-street, for improvements in apparatus for retarding and stopping carriages, especially applicable to railway carriages, and in disconnecting apparatus for carriages,—being a communication.

The above bear date July 24th.

2111. James Redgate, of Sneinton, Nottinghamshire, and Herbert Redgate, of Nottingham, for improvements in machinery or apparatus for the manufacture of fabrics on bobbin net or twist lace machines.

2113. Peter Robertson, of Glasgow, for improvements in producing brushing or frictional surfaces.

2115. James Seymour, of Queenstown, county Cork, and Daniel George Hatcher, of Southampton, for improvements in steering ships, and in apparatus for the same.

2117. Vincenzo Manzini, of Modena, for certain improvements in the construction of locomotive engines used on railways; for facilitating and controlling the ascent and descent of locomotive engines and trains on inclined planes of lines of railway; and for simplifying the construction of locomotives used on railways.

2119. Adolphus Lahousse, of Brussels, for an improved construction of railway wheel.

The above bear date July 25th.

2121. Thomas Sagar and John Rocliff, both of Burnley, for improvements in moulding.

2123. William Clark, of Chancery-lane, for improvements in obtaining or extracting silver from ores and other bodies, and in apparatus for the same,—being a communication.

2125. Thomas Long, of Clarendon-place, Notting-hill, for improvements in the manufacture of open metal work, applicable to various useful purposes.

The above bear date July 26th.

2130. William Spence, of Chancery-lane, for improvements in the preparation of a red coloring matter,—being a communication.

2131. Patrick Sarsfield Devlan, of Commercial-street, Manchester, for certain improvements in the manufacture of telegraphic cables.

2132. William Spence, of Chancery-

lane, for improvements in the preparation of a blue coloring matter,—being a communication.

2135. Thomas Cook, of Manor-place, Walworth, for improvements in apparatus employed in the manufacture of envelopes.

2137. Joseph Fourdrinier, of Grove-terrace, Peckham, for improvements in apparatus for removing knots from pulp.

2139. Fraser Selby, of Surbiton, for improvements in surface condensers.

2141. Edmund Burnett, of Ashford, for an improved combined cart and sleigh.

2143. Charles William Siemens, of Great George-street, Westminster, for improvements in gas engines.

The above bear date July 28th.

2145. Zerah Colburn, of Tavistock-street, Bedford-square, for improvements in steam pumping engines.

2147. Arthur Boyle and Thomas Warwick, both of Birmingham, for improvements in the manufacture of the ribs and stretchers of umbrellas and parasols, and in machinery to be employed in the said manufacture.

2149. Patrick Sarsfield Devlan, of Manchester, for an improved composition to be employed for covering projectiles and the internal and external surfaces of vessels; which is also applicable to the manufacture of tubing, and to other useful and ornamental purposes.

2150. James Norris, of Great Russell-street, Bloomsbury, for improvements in the arrangement or construction of ovens.

2151. Charles Thomas Burgess, of Brentwood, for an improved stand for beer and other casks.

2152. George Waldie, of Linlithgow, for improvements in color printing, and in the machinery or apparatus employed therein.

2153. James Mapple, of Newman's-place, Kentish Town, and Daniel Mapple, of Homerton, for improvements in telegraphic apparatus.

2155. Michael Henry, of Fleet-street, for improvements in obtaining fibrous materials and paper pulp, in treating, cleansing, and scouring fibrous materials and fabrics manufactured thereof, in producing soap for the said operations, and in obtaining products from liquors used therein,—being a communication.

The above bear date July 29th.

2156. George Nock, of Brierley Hill, Staffordshire, for a new or improved safety or moveable self-acting crossing for railways,—being a communication.

2158. William Edward Gedge, of Wellington-street, Strand, for improved means or apparatus for securing the safety of trains moving on railways,—being a communication.

2159. Joseph Hyde and Jessie Hyde, both of Bradbury, Cheshire, for certain improvements in governors for steam engines, water wheels, mills, and for other similar purposes.

2160. Benjamin Bailey, of Leicester, for improvements in means or apparatus for cutting chaff and other vegetable matters; which improvements are also applicable to cutting or mowing short or lawn grass.

2162. William Wanklyn, of Bury, Lancashire, for improvements in apparatus for opening and conditioning East Indian and other tightly compressed cottons.

2163. John Benyon, of Swinton, near Manchester, for certain improvements in looms for weaving.

2164. George Henry Birkbeck, of Southampton-buildings, for improvements in the means or processes employed for preserving timber from decay or destruction,—being a communication.

2165. William Clark, of Chancery-lane, for improvements in gas burners,—being a communication.

2166. Thomas Holt and Frederick Luke Stott, both of Rochdale, for an improved composition or compositions for protecting polished surfaces of iron and steel against oxidation, and for renewing and improving the polish of such surfaces.

2168. James Willis Dixon, junior, of Sheffield, for improvements in coffee urns.

2169. John Wyman Woodford, of Sutherland-street, Walworth, for im-

provements in machinery for raising or forcing water.

The above bear date July 30th.

2170. Elijah Freeman Prentiss, of Birkenhead, and Robert Adam Robertson, of Liverpool, for improvements in obtaining products from rock oil, coal, coal tar, and other like mineral substances, in a more or less pure and deodorized state, and in the apparatus to be used therefor, and which is also applicable to distillation in general.

2171. William Weild, of Manchester, for improvements in machines for cutting, shaping, rolling, drilling, screwing, milling, and fluting metals.

2172. Joshua Ransom and Edwin Ransom, both of Kempston, Bedfordshire, for improvements in mounting mill-stones.

2173. Caleb Bedells, of Leicester, for improvements in the manufacture of braces.

2174. George Tomlinson Bousfield, of Loughborough-park, Brixton, for improvements in the manufacture of fluids suitable for burning in lamps, and for other uses,—being a communication.

2175. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improved machinery for planing metal,—being a communication.

2176. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in lubricating compounds,—being a communication.

The above bear date July 31st.

2177. James List, of Carisbrooke, Isle of Wight, for an improved means of, and instruments for, obtaining distances and heights and distances between distant objects, without computation.

2178. John Sinclair, of Glasgow, for improved arrangements for ventilating, and in part applicable for fumigating.

2179. David Thorpe Lee, of Birmingham, for an improvement or improvements in ornamenting surfaces of wood and of papier-maché.

2180. George Haseltine, of Fleet-street, for improvements in apparatus for drying grain, gunpowder, and other granular substances,—being a communication.

2181. George Arthur Biddell, of Ipswich, for improvements in railway crossings.

2182. John Collingwood Onions, of Birmingham, for improvements in portable forges.

2184. John Edwin Marsh, of Birmingham, for an improvement or improvements in metal rivets used in joining or securing together parts of boots, shoes, and other articles of leather; and also in machinery for making such rivets.

2187. Thomas George Webb, of Manchester, for improvements in the manufacture of flint glass.

The above bear date August 1st.

2188. Thomas Onion, of Calais, for improvements in rotary steam engines, and in propellers adapted to propelling vessels in water.

2189. James Briggs, of Blackley, Lancashire, for improvements in the manufacture of belts, webs, braids, tapes, laces, and other similar articles produced by weaving, plaiting, or twisting.

2190. James Gray, of Glasgow, for improved arrangements for cleaning ships' bottoms, and for preventing the fouling thereof.

2191. Edward Brown Wilson, of Parliament-street, and Maurice Picard, of Lyons, for improvements in the manufacture of iron and steel.

2192. Charles Warne, of Syleham Mills, Norfolk, for improvements in the manufacture of linen drabbett.

2193. George Coles, of Gresham-street West, and James Archibald Jaques and John Americus Fanshawe, both of Tottenham, for improvements in the manufacture of grinding and polishing tools and surfaces.

The above bear date August 2nd.

2194. Abraham Denny and Edward Maynard Denny, both of Waterford, Ireland, for improvements in the manufacture of bacon.—[*Dated August 4th.*]

2195. Siegfried Simon, of Tuilerie-street, Hackney-road, for an improvement in ornamenting ladies' and children's slippers.

2196. Joseph Thoma, of Bingen Hohenzollern, Prussia, for an improved self-adjusting screw-wrench.
2198. Joseph Townsend, of Glasgow, for improvements in damping cotton and other fibrous materials and fabrics, in preserving the same from mildew, and in preserving size or stiffening from decomposition.
2199. William Clark, of Chancery-lane, for improvements in the purification of water, and in apparatus employed therein,—being a communication.
2200. Martyn John Roberts, of Pendarren House, near Crickhowell, Brecon, for improvements in means or apparatus for spinning and preparing wool and other fibrous substances.
2201. John Richard Nicholl, of Streatham, for improved means of, and apparatus for, utilizing and disposing of the sewage of towns and villages.
2202. Abraham Priestley, of Huddersfield, for improvements in arrangements or apparatus applicable to locomotive railway engines and carriages for distributing sand upon the rails to give adhesion to the driving and brake wheels of such engines and carriages.

The above bear date August 5th.

2203. William Wharton Burdon, of Newcastle-upon-Tyne, for improvements in reducing wood fibres to pulp.
2204. James Cope Richardson, of Lichfield, Staffordshire, for an improvement or improvements in cleaning cotton waste.
2205. Marie Celeste Sinibaldi, of Greenwich, for improvements in the manufacture of chains, and in the apparatus employed therein.
2206. William George Valentin, of Oxford-street, and Frederick Levick, of Blaina, Monmouthshire, for improvements in the generation of combustible gases for lighting and heating purposes, and in the mode of applying such gases to the manufacture of iron, glass, and other processes in the arts where great heat is required.
2207. Ferdinand Nauheim, of Cecil-street, Mile-end-road, for an improvement in the ornamenting of boots, shoes, and goloshes.
2208. John Henry Johnson, of Lincoln's-inn-fields, for improvements in the construction of armour plates for ships and forts, and applicable to other like purposes,—being a communication.

The above bear date August 6th.

2209. Marc Antoine François Mennons, of Paris, for an improved self-inking hand stamp,—being a communication.
2210. Charles Culling, of Downham Market, Norfolk, for improvements in fire-arms.
2213. John Henry Johnson, of Lincoln's-inn-fields, for improvements in blast furnaces,—being a communication.
2214. Richard Archibald Brooman, of Fleet-street, for improvements in ships and vessels, in order to prevent injury from collisions,—being a communication.
2215. Richard Archibald Brooman, of Fleet-street, for improvements in covering ships and vessels built of wood, or iron ships, with a backing of wood, before placing iron, steel, or other armour plate on such ships and vessels,—being a communication.
2216. William Clark, of Chancery-lane, for improvements in the rig, spars, and sails of ships and other vessels,—being a communication.
2217. Benjamin Coombe, of Mark-lane, for improvements in apparatus or machinery for cleaning and decorticating wheat and other grain.
2218. Rowland Westby Ralph, of Honnington Grange, near Newport, Salop, for certain improvements in, or applicable to, reaping machines.

The above bear date August 7th.

2219. Edward Hall, of Luddenden Foot, near Halifax, for improvements in means or apparatus for preparing foreign grain for grinding.
2221. Francis Montgomery Jennings, of Cork, for a composition for coating ships' bottoms to prevent fouling.
2222. John Whipp, of Rochdale, for an improved arrangement of appa-

ratus and means for cleaning articles of ornament and jewellery.

2223. Nathaniel Jones Amies, of Manchester, for certain improvements in the manufacture of bearings, "journals," and "steps," employed in machinery, and for carriage and other axles.

2224. Richard Archibald Brooman, of Fleet-street, for improvements in repeating fire-arms,—being a communication.

2226. Edward Humphrys, of Deptford, for improvements in steam engines.

2227. John Tatham, of Rochdale, for improvements in machinery or apparatus for preparing, spinning, and weaving cotton and other fibrous materials; parts of which improvements are also applicable to other mechanism, in which an uniform or variable rotatory motion is required.

The above bear date August 8th.

2228. John Macintosh, of North Bank, Regent's-park, for improvements in obtaining and applying motive power.

2229. Robert Fowler, of Glasgow, for an improved manufacture of woven, plaited, knitted, and other fabrics.

2230. George Haseltine, of Fleet-street, for improvements in carriage wheels,—being a communication.

2231. Sir John Scott Lillie, of Pall-mall, for improvements in carriage ways and footways.

2233. Alexis Jean Moreau and Adolphe Ernest Ragon, both of Bernard-street, Russell-square, for improvements in the mode of, and apparatus for, treating bituminous and carbonaceous substances for the purpose of obtaining the various products, volatile, liquid, and solid, which they contain, and also in the treatment and application of such products.

2234. Alexis Jean Moreau and Adolphe Ernest Ragon, both of Bernard-street, Russell-square, for improvements in the manufacture of gas and coke.

2235. Thomas De la Rue, of Westbourne-terrace, for improvements in the manufacture of pigments and writing inks.

2236. George Tomlinson Bousfield, of Loughborough-park, Brixton, for improvements in apparatus to be used in the manufacture of hat bodies,—being a communication.

The above bear date August 9th.

2237. Henry Bernoulli Barlow, of Manchester, for improvements in machines for weaving, warping, sizing, and dressing,—being a communication.

2238. Hugh Fenton and William Stubbs, both of Liverpool, for improvements in telegraph wires.

2239. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improved machinery for compressing powder for cartridges,—being a communication.

2240. Jacob Goodfellow, of Blackburn, for improvements in steam or water engines.

2241. Tom Holdsworth and John Crossley, both of Halifax, Yorkshire, for improvements in means, machinery, or apparatus for warping, scouring, sizing, stretching, measuring, cooling, drying, and beaming yarns for weaving.

2242. William Clark, of Chancery-lane, for an improved carriage for conveying sugar moulds in sugar refineries,—being a communication.

2243. Nathaniel Jones Amies, of Manchester, for improvements in the manufacture of bearings or steps employed in machinery, and railway and other carriages, and in a composition to be applied thereto.

2245. Marie Honoré Champion, of Paris, for self-closing buttons, fastening without thread or needles.

2246. William Edward Gedge, of Wellington-street, Strand, for improvements in the construction of ladders,—being a communication.

2247. John Combe and John Henry Smalpage, both of Leeds, for improvements in the action and arrangement of machines for winding cops, and in apparatus for holding and receiving such cops when used for warps or sewing thread, or other purposes.

2248. Hugh Donald, of Johnstone, Renfrewshire, N.B., for improvements in machinery for shearing, punching, and riveting metals.

2249. Alfred Joseph Martin, of Bow,

James Goss, of Bow-road, and John Bush, of Bow-common, for improvements in apparatus for distillation.

2250. Roger Gresty, of Packington-street, Islington, for improvements in scarfs or cravats.

The above bear date August 11th.

2251. William Macnab, of Greenock, N.B., for improvements in steam boilers, and in apparatus for feeding the same, and for effecting circulation therein.

2252. John Ramsbottom and George Hacking, both of Accrington, for improvements in machinery or apparatus for measuring and registering the flow of water and other fluids.

2253. James Dickson, of Tollington-road, Holloway, for improvements in treating zinc ores and solutions of zinc, to obtain zinc therefrom.

2254. James Dickson, of Tollington-road, Holloway, for improvements in treating ores and solutions of lead, to obtain lead therefrom.

2255. Louis Serbat, of Valenciennes, for certain improvements in lubricating machinery.

2256. Charles Anthony Wheeler, of Swindon, for improvements in machinery for perforating paper.

2257. Alexander Delrue, of Dunkirk, France, for improvements in compositions for preventing and removing incrustation in boilers.

2258. Charles Martin Westmacott, of Noble-street, for improvements in cements.

2259. James Langran, of Kimbolton, Huntingdonshire, for improvements in apparatus for driving agricultural machinery.

2261. Augustus Bryant Childs, of Oxford-street, for improvements in machinery for cutting veneers,—being a communication.

2262. Charles Sengry, of Great Queen-street, for an improved smoking pipe, which may also be adapted as a tube for smoking cigars.

2263. George Sanders, of Nelson-place, Old Kent-road, for improvements in domestic fire escapes.

2264. John Bower, of Carlow, for improvements in railway sleepers.

The above bear date August 12th.

2265. James Dickson, of Tollington-road, Holloway, for improvements in the manufacture of chlorine for commercial purposes.

2266. James Dickson, of Tollington-road, Holloway, for improvements in obtaining sodium from certain sources of that metal.

2267. John Cooper, of Town Malling, Kent, for improvements in valves and buckets for pumps, and in valves or cocks for other uses.

2268. John Smith, of Regent-street, Mile-end-road, and John Saunders Rayment, of Rayment-road, Mile-end, for improvements in apparatus for generating steam, and for regulating its flow; part of which improvements are applicable also to other purposes.

2269. Joseph Randall Tussaud and Francis Curtius Tussaud, both of Marylebone-road, for improvements in the treatment of representations formed from wax, or from compositions of wax with other matters.

2270. Charles William Smith and William Mould, both of Belmont, Lancashire, and Samuel Cook and William Henry Hacking, both of Bury, for improvements in looms for weaving.

2271. William Lafferty Boyle, of San Francisco, for improvements in the construction of chairs and foot stools for the use of dentists, and in chairs, couches, and beds for invalids.

2272. Joseph Peters, of Rochester, for an improved hydraulic cement.

2273. Harper Twelvetrees, of Bromley, Middlesex, for improvements in rat and mice traps.

2274. George Turner, of Woolwich Dockyard, for improvements in fastening armour plates of ships.

2275. Louis Désiré Verstraet and Etienne Maurice Olivier, both of Paris, for a new process of manufacturing carbonate of soda by the application of sulphuret of sodium, and in apparatus for the same.

2276. Leonardo Galli, of Lucca, Italy, for improvements in apparatus for propelling vessels.

2277. William Schnell, of Charlotte-street, Fitzroy-square, for improvements in extracting the sulphur and sulphurous acid from the oxy-sul-

phuret of calcium which is contained in the residues or waste material obtained in the manufacture of soda,—being a communication.

2278. John Henry Johnson, of Lincoln's-inn-fields, for improvements in carts and other vehicles,—being a communication.

The above bear date August 13th.

2279. Eliza Jane Dagnall, of Wandsworth, for an improved tray or receptacle adapted for washhand-stands, for holding tooth-brushes, tooth-powder, and nail-brushes.

2280. Alexander Walker, of Liverpool, for a new instrument to determine or ascertain the depth of water, and the distance a ship has run.

2281. John Irvine, of Patshull, and John William Hand, of Beckbury, both in Salop, for a new or improved rifle rest.

2282. John Key and Ebenezer Hoskins, both of Birmingham, for an improvement or improvements in the manufacture of plain and ornamental metallic pillars for bedsteads, cots, couches, tables, and other like purposes.

2283. George Welch, of Birmingham, for improvements in inkstands, metallic pens and penholders, and other instruments and appliances used in writing and marking.

2284. Charles Edmund Wilson, of Monkwell-street, for an improvement in buckle fastenings for braces and belts.

2285. William Beatson, of Rotherham, for improvements in the manufacture of stoves.

2286. George White, of Torquay, Francis Buckland, of Newton Abbot, and Charles Rees, of Newton Bushel, for improvements in the manufacture of water closets.

2287. Don Pelegrin Marques, of Barcelona, for improvements in apparatus for cleaning the bottoms of ships and vessels,—being a communication.

2288. Henry Richard Passey and Louis Niman, both of Little Newport-street, Leicester-square, for an improved cigar tube or holder.

2289. John Petrie, junior, of Rochdale, for improvements in machinery or apparatus for blowing and exhausting air.

2290. William Joseph Curtis, of Tufnell-park-road, Holloway, for an improved mode of, and apparatus for, ascertaining the fares and earnings of public vehicles.

2291. James Hopwood, of Ashton-under-Lyne, for improvements in machinery or apparatus used for collecting fibrous material and dirt from the carriage boards and roller beams of mules and other similar machines used in spinning.

2292. James Hearn, of Hatford, Berks, for improvements in apparatus or appliances for raising sick or bed-ridden persons in their beds, and for lifting their bed-clothes.

2293. William Soutter, of Birmingham, for certain apparatus for raising and planishing metals.

2294. William Bird Herapath, of Bristol, for improvements in decolorizing solutions of sugar, and also vegetable juices containing sugar.

2295. John Sanders Blockey, of Leeds, for improvements in the manufacture of colouring matters.

2296. William Bird Herapath, of Bristol, for improvements in treating crystallizable sugar, to render it more suitable for fermentation and conversion into alcohol and vinegar.

2297. Charles Ernesto Spagnoletti, of the Telegraph Department, Great Western Railway, for improvements in apparatus for signalling trains on railways.

The above bear date August 14th.

2300. Anne Shepard, of Victoria-street, Westminster, for improvements in obtaining light, and in apparatus connected therewith.

2301. Thomas Carvin, of Landport, Hants, for improvements in screw-propellers.

2302. Thomas Freeston Kirby, of Aldersgate-street, for improvements in garments for gentlemen and ladies' wear.

2303. James Newman, of Birmingham, for improvements in machinery for the manufacture of metallic tubes.

2304. John Carter and James Maher, both of Lockwood, near Hudders-

field, for an improvement in the construction of power looms.

2305. John Henry Johnson, of Lincoln's-inn-fields, for improvements in electro-magnetic time-keepers,—being a communication.

The above bear date August 15th.

2306. Robert Barclay, of Paris, Canada West, for improvements in chronometers and other time-keepers.

2307. Henry Garside, of Manchester, for improvements in machinery or apparatus for marking, etching, or engraving on cylindrical and other surfaces.

2308. Charles Henry Julius William Maximilian Liebmann, of Huddersfield, for improvements in machinery for finishing textile fabrics.

2309. Thomas Knowles and William Robinson, both of Manchester, for improvements in racks for window blinds.

2310. Manuel Iturriaga, of Tavistock-street, Bedford-square, for improvements in fire-arms.

The above bear date August 16th.

2312. George Chapman, of Edinburgh, for improvements in reaping machines.

2313. Frederic Barnett, of Paris, for an improved lamp or lantern for street lighting and other purposes.

2314. John Cimeg, of Great James-street, Bedford-row, for improvements in depositing silver and other metals on fabrics and other materials.

2315. John Thomas Oakley, of Grange-road, Bermondsey, for improvements in heating stoves employed for drying and other purposes.

2316. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in connecting plates, sheets, or slabs of metal or other materials, and fastening the same on to framing; applicable to armour plating for ships, vessels, or batteries, and to roofing and other similar purposes,—being a communication.

2319. Henry Melton, of Regent-street, for improvements in the manufacture of hats and caps.

The above bear date August 18th.

2320. Thomas Wilkinson, of Rathmines, Dublin county, for improvements in machinery or apparatus for singeing pigs.

2321. Victorin Florintin Cluet, of Paris, for an improved self-acting apparatus for supplying boilers with water; applicable also to the raising and to the measuring of liquids.

2322. General Henry Dembinski, of Paris, for a motive apparatus, and processes proper for giving to it a continuous motion and unlimited strength.

2323. Simon Boucher, of Warchin, near Tournai, Belgium, for improvements in flax spinning; which improvements are also applicable to spinning of tow and hemp.

2324. William Jennings Hoyle and John Proven, both of Halifax, for improvements in mechanism and arrangements for supplying lubricating matter to the cylinders of steam engines and to the bearings and other surfaces of mechanism.

2325. Travers Hartley Falkiner, of Dublin, for improvements in the permanent way of railways.

The above bear date August 19th.

2326. John Garrett Tongue, of Southampton-buildings, for improvements in processes and apparatus for extracting the natural wax or fatty matters from wool, hair, or other animal or vegetable substances containing the same, and in the application thereof to various useful purposes,—being a communication.

2328. Charles Callebaut, of Paris, for improvements in sewing machines.

2330. William Hodgson Hutchinson, of Newton Heath, near Manchester, for improvements in the manufacture of ammonia and the prussiates of potash or soda, and in apparatus employed in such manufactures.

2331. John Standish and John Gooden, both of Egerton, near Bolton, for improvements in machinery or apparatus used in the preparation of cotton, wool, flax, or other fibrous materials to be spun.

2332. Samuel Wilkes, of Paris, for an improved attachment for door knobs.

2333. Charles Chinnock, of Brooklyn, New York, for an improved construction of corkscrew.

The above bear date August 20th.

2334. Stanislaus Joseph Paris, of Manchester, and William Bate, of Salford, for improvements in alphabetical electric telegraphs.

2335. Johann Carl Schemmann, of Hamburg, for improvements in the manufacture of steel.

2337. George Davies, of Serle-street, Lincoln's-inn, for improvements in governors for steam engines,—being a communication.

2338. Thomas Clements, Peter Llewellin, John Llewellin, and John Wanklyn James, all of Bristol, for improvements in the construction of a self-acting lubricator, for lubricating various parts of steam engines.

2340. Adolphe Boubée, of Paris, for an improved veil protector.

The above bear date August 21st.

2341. Sandiforth Featherstone Griffin, of the New Adelphi Chambers, for improvements in apparatus to be used in the distillation of petroleum or any oleaginous, resinous, or alcoholic bodies.

2344. William Barrett, of Norton Furnaces, near Stockton-on-Tees, for improvements in casting railway sleepers and chairs where tie bars are used.

2346. James Mackay, of Glasgow, for improvements in the manufacture of soap powder.

2347. Robert Harrington, of Birmingham, for improvements in umbrellas and parasols, and in the manufacture of parts thereof.

2349. Daniel Moore, of Brooklyn, New York, for improvements in breech-loading fire-arms.

2350. George Bottomley, of Leeds, for improved apparatus for expressing moisture from pulpy or solid substances.

2351. Daniel Moore, of Brooklyn, New York, for improvements in revolving fire-arms.

2352. William Carwood, of Stepney, William Boaz, of Bromley, and Charles Colwell, of Belvidere-place, Southwark, for improvements in apparatus for propelling ships and other vessels.

2353. Thomas Wood, of Manchester, for improvements in the slide valves of steam engines.

The above bear date August 22nd.

2357. Martin Kenneth Angelo, of Gloucester-place, Portman-square, for improvements in apparatus used in the manufacture of shell-lac.

2358. Michael Henry, of Fleet-street, for improvements in stuffing boxes and their packings,—being a communication.

2359. Carl Heinrich Roeckner, of Bristol, for improvements in syphons for discharging or drawing off large bodies of water, and in the mode of charging, fixing, and constructing same, whereby they are rendered permanently self-acting.

2360. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the mode of, and apparatus for, treating fermentable substances for brewing and distilling,—being a communication.

The above bear date August 23rd.

2361. Michael John Haines, of Bristol, for improvements in the manufacture of driving bands or straps.—[*Dated August 25th.*]

2366. Thomas Richardson, of Newcastle-upon-Tyne, and Richard Allinson, of Moorgate-street, London, for improvements in the manufacture or treatment of articles of steel, and in the apparatus employed therein.

2368. Joseph Rider, of Leeds, for improvements in the construction of fencing posts or standards, to be used either for straining or otherwise sustaining fences; the said improvements being also applicable to all kinds of gate posts, telegraph poles, signal posts, or other upright standards or pillars.

The above bear date August 26th.

2370. Alexander Crichton, of Glasgow,

for improvements in looms for weaving ornamental fabrics.

2372. Henry Harben, of Oxford-villa, Haverstock-hill, for improvements in the manufacture of paper and other productions in which fibrous material is employed.

2374. Reuben Sims, of Leigh, Lancashire, for improvements in machinery or apparatus for pulping, stripping, or slicing turnips and other vegetable substances.

2378. William Millbanke Mayes, of Hoxton, for an improvement in, or addition to, wheels; particularly applicable to the wheels of railway and other carriages.

2380. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for an improved method of producing light for the various purposes of artificial illumination,—being a communication.

2382. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improved machinery for printing from engraved plates,—being a communication.

2384. John Jennings Potter, of Dover, for improvements in upright pianofortes.

The above bear date August 27th.

2388. George Biddle, of Birmingham for an improvement or improvements in the manufacture of brooms.

2390. Elizabeth Lachenal, of Little James-street, Bedford-row, for improvements in gas meters,—being a communication.

2392. Grattan Cooke, of Mornington-crescent, Hampstead-road, for an improved apparatus for securing or fastening doors to prevent robbery or intrusion.

The above bear date August 28th.

2394. Pierre Léonard Guilbaud and Napoleon Victor Thire, both of Paris, for an improved self-inking hand stamp.

2396. François Henry Lefranc, of Paris, for improvements in the manufacture of casks.

2398. John Davis, of Liverpool, for improvements in the manufacture of spoons, forks, and similar articles,—being a communication.

2400. George Walter Dyson, of Tinsley, Yorkshire, for improvements in machinery for finishing and polishing circular metal rods, bars, and shafts; applicable also to the manufacture of metal tubes and pipes.

2404. William Upfill, William Morton, and William Asbury, all of Birmingham, for improvements in the construction of wheels and axletrees for carriages.

The above bear date August 29th.

2406. Edward Thomas Hughes, of Chancery-lane, for improvements in the manufacture of woven fabrics, and in apparatus employed therein,—being a communication.

2408. Felix Le Conte, of Tournay, Belgium, for improvements in the construction of furnaces for steam boilers used in sugar mills, distilleries, breweries, and other mills or factories.

The above bear date August 30th.

2414. James Walker, of Glasgow, for improvements in the treatment of kelp, and in the manufacture of products therefrom.

2416. John Ellis, of Bristol, for improvements in corsets.

The above bear date September 1st.

2424. David Bruce Peebles, of Edinburgh, for improvements in wet gas meters.

2426. William Hunt, of Tipton, for an improvement or improvements in the manufacture of muriate of ammonia.

2428. Richard Glanville, of Bermondsey, for certain improvements in marine and other engines.

2430. William Roberts, of Millwall, for improvements in apparatus for regulating the amount of water discharged by a pump; chiefly applicable for regulating the amount of water thrown by a steam fire engine, or for regulating the amount of water fed to a steam boiler.

The above bear date September 2nd.

2434. Charles Garton, of Bristol, for an improved method of applying heat in the manufacture and refining of sugar, and in malting, hop dry-

ing, brewing, distilling, and vinegar making.

2438. William Henry Atkinson, of the Cavendish Club, Regent-street, for improvements in studs or fastenings adapted to holding together parts of shirt fronts, wristbands, collars, gloves, and other articles of wearing apparel.

2440. Eli Dyson, of Little Hulton, near Bolton, for improvements in throstle spinning and doubling machines.

The above bear date September 3rd.

New Patents Sealed.

471. W. H. Ross.
472. James Kirkwood.
473. Augustus Bornemann.
476. C. H. J. W. M. Liebmann.
480. G. Blakey, S. Blakey, J. Blakey, and B. White.
482. Robert Foster, jun.
485. William Johnston.
488. J. C. Haddan.
489. Richard Waller.
495. L. Davis and F. M. Parkes.
497. Frederick St. George Smith.
502. John Piddington.
504. E. Bliss and H. Lamplough.
506. T. Watson and R. Dracup.
512. Courtenay Kingsford
514. H. W. Cook.
516. Alfred Green.
517. Alexander Stephen, jun.
523. T. King and R. Varvill.
524. John Cliff.
526. C. L. Knoll.
529. W. P. Savage.
530. John Medhurst.
531. John Smith, sen.
532. George Torr.
533. Thomas Adams.
536. William Smith.
538. Sir C. T. Bright.
541. J. R. Foster.
542. W. S. Wood.
543. Joseph Revell.
544. P. D. Azemar.
545. W. H. Muntz.
546. A. W. Makinson and W. F. Batho.
552. James Parker.
554. Thomas Bradford.
557. Matthew Dodds.
561. Samuel Hague.
562. A. E. Ragon.
563. Andrew Potts.
564. Patrick Robertson.
566. J. G. Jennings.
568. Louis Martin.
570. J. W. Davis and F. Davis.
576. Joseph Schofield.
578. Thomas Tillam.
579. Alfred Bedborough.
582. William Conisbee.
588. P. and F. Schäfer.
591. A. J. Sedley.
592. G. H. Cottam and H. R. Cottam.
594. G. F. Guy.
597. J. Somervell, R. M. Somervell, and M. Blanc.
600. Thomas Bostock.
604. Jonathan Barker.
607. J. G. Shipley.
612. J. Fowler, jun., D. Greig, and R. Noddings.
613. T. and W. Ball and J. Wilkins.
614. Richard Wright.
616. Richard Restell.
617. T. H. Wood.
619. A. W. Williamson.
621. George Edmonson.
622. Andrew Blair.
623. W. Paterson, W. A. Sanderson, and R. Sanderson.
625. J. Platt and W. Richardson.
626. John Deane, jun.
628. P. J. Guyet.
631. William Palmer.
640. R. A. Brooman.
641. W. Parker and G. H. Batman.
642. William Spence.
645. W. S. Nosworthy.
646. Andrew Barclay.
647. J. B. G. M. F. Piret.
648. J. T. Calow.
652. Jean Nadal.
656. O. Kerautret and J. Kerautret.
657. E. G. Camp.
658. Collinson Hall.
659. T. B. Wilson and W. Wilson.
662. George Davies.
664. A. R. Le Mire de Normandy.
670. J. Johnson and S. Morris.
671. William Conyers.
673. Paul Gondolo.
674. A. M. A'Beckett.
682. Lucien Vidie.
683. J. and R. Cunningham.
684. John Hunter.

687. James Wadsworth.
690. S. V. Bonneterre, C. T. Erhart, and J. F. Monti.
691. Michael Henry.
692. R. A. Brooman.
701. Alexander Quinard.
703. G. H. Birkbeck.
706. L. Gabler and M. Zingler.
707. G. T. Bousfield.
708. A. J. Paterson.
709. M. A. Muir and J. Mc Ilwham.
710. William Turner.
711. A. and W. Coles.
714. C. N. Kottula.
715. G. B. Pettit.
716. Julien Smadja.
717. William Mc Adam.
718. J. Hunter and R. Scott.
721. S. N. De la Haye De Barbezières.
723. George Hamilton.
724. James Robey.
725. William Pickstone.
726. J. T. Pendlebury & T. Pendlebury.
728. A. S. Stocker and A. R. Stocker.
730. W. B. Lord and F. H. Gilbart.
731. L. P. Mongruel.
732. William Bowser.
734. J. and W. Weems.
738. G. T. Bousfield.
739. J. M. Courtauld.
742. William Gossage.
743. Thomas Waller.
744. Thomas Myers.
746. M. A. F. Mennons.
749. James Banks.
758. Samuel Slack.
760. R. A. Brooman.
763. R. Hadfield and J. Shipman.
765. Robert Wilson.
766. Sampson Moore.
771. John Cumming.
773. Bernhard Samuelson.
782. D. E. Siebe.
797. Edward Lord.
799. Robertson Gladstone.
807. Michael Henry.
815. E. Morewood and A. Whytock.
825. E. Morewood and A. Whytock.
831. J. H. Johnson.
836. Robert Boby.
842. A. V. Newton.
859. W. F. Smith and A. Coventry.
863. W. A. Ashe.
866. E. T. Noualhier.
876. C. H. Townsend, J. Young, and J. Hankins.
886. John Clinton.
913. Henry Smith.
915. H. W. Caslon and G. Fagg.
934. William Clark.
941. John Newton.
957. L. Smaley and F. Taylor.
1017. W. E. Newton.
1020. Edward Funnell.
1044. J. F. Mathias.
1078. G. Fell and W. Haynes.
1084. A. V. Newton.
1107. W. E. Newton.
1108. W. E. Newton.
1109. John Stanton.
1124. G. T. Bousfield.
1152. James Combe.
1162. Charles Callebaut.
1189. W. E. Newton.
1231. S. and G. Cheavin.
1245. G. R. Samson.
1247. J. W. Caley and F. G. Caley.
1248. J. E. A. Gwynne.
1261. W. E. Newton.
1282. A. H. Fielden.
1379. J. Fowler and J. King.
1395. James Oxley.
1402. J. F. Milward.
1419. J. B. Pope.
1491. Nathan Thompson.
1604. H. Saunders and J. H. Miles.
1610. John Critchley.
1618. Robert Griffiths.
1733. J. G. Appold.
1812. J. B. Wood.
1830. James Taylor.
1845. George Haseltine.
1879. J. H. Johnson.
1884. E. Hunt and H. D. Pochin.
1886. J. Lord and J. Brown.
1896. Charles Beslay.
2040. A. V. Newton.

*** For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.*

NEWTON'S
London Journal of Arts and Sciences.

No. XCV. (NEW SERIES), NOVEMBER 1ST, 1862.

AMERICAN PETROLEUM.

IN the departments of the International Exhibition devoted to the display of the produce of the United States of America and of Canada, respectively, there will be found a number of specimens of the native mineral oil or petroleum lately discovered in those regions. The cases in which this earth oil is placed contain, likewise, collections of the various liquids obtained from it by certain processes of manufacture. Altogether the contents of these cases possess a high degree of interest —first, by reason of the character of the material and the remarkable circumstances under which it is found; and, secondly, because of the important bearing which the discovery of this substance might have upon established branches of industry.

Within the last ten years the attention of scientific men and manufacturers has been directed to the examination and production, on the large scale, of a class of combustible materials, of which the solid spermaceti-like substance, called paraffine, is one of the most interesting members, but which consists chiefly of liquids of greater or less specific gravity, and varying volatility. All the members of this class of substances are what chemists call hydro-carbons, and the chemical composition of paraffine is the general type of their constitution. Paraffine possesses precisely the same composition as olefiant gas, which is one of the most illuminative of the constituents of coal gas, and indeed, in a certain sense, it may be considered as olefiant gas in the solidified form.

All these remarkable and useful substances—that is paraffine and the various liquids spoken of—may be obtained from the mineral oils or petroleum of Canada and the United States; and as the production of these commodities from other materials already constitutes an immense trade, it will be seen at once that the introduction of these new petroleums, in quantity altogether unexpected, and almost beyond belief, and the lowness of price consequent thereon, must be a serious and important subject for the consideration of those who are engaged in the manufacture of materials of a similar character.

When first the oil springs, as they are termed, were discovered,

the oil was obtained near the surface, but after a time, as the surface supply seemed in some degree to fail, it was determined to sink wells to a considerable depth; in the expectation that larger and more regular quantities of the oil might be obtained. In many spots this was done, with the most astounding results; for upon digging down from the surface 20 or 30 feet, a stratum of soft limestone was reached, through which the oil seemed to be percolating; it then began to rise rapidly in the wells, apparently upon the artesian principle; and in some instances such an enormous quantity of oil made its way to the surface, that it was found impossible to collect it; and it was necessary to cut a channel to the nearest stream, so that it might be carried off in the quickest and readiest manner. The stories that have been told concerning the quantity of oil produced by the wells, collectively, seem incredible; but it is stated authoritatively that the wells of Canada are yielding no less than 40,000 barrels, or 1,600,000 gallons of oil per day. What may be the effect of this supply, should it continue, upon the different branches of manufacture concerned in producing the materials of artificial lighting, it is impossible to say, but it is easy to perceive, that such an influx of new material so far resembling the old as to be applicable in some respects to similar uses, must produce very striking and important changes.

The combustible liquids which are obtained by distilling these petroleums are employed for lighting purposes in the kind of lamps known as paraffine-oil lamps; and heretofore—that is, before the introduction of the American petroleum—oils similar in chemical composition, and suitable to similar purposes, were obtained by distilling either native mineral oil—such as the Rangoon earth oil, or solid mineral substances of the cannel coal class—such, for instance, as the Boghead cannel coal, found at Falkirk, in Scotland. These substances yield, by distillation, products identical in their chemical character with the oils from the American petroleum. But there is a very important difference between them in one respect: although all the oils obtained from these different sources possess, as has been said, the same per centage respectively of carbon and hydrogen, it is probable that the mode of combination in each member of the series differs; the whole series being made up of a great number of members, which, although they have the same chemical per centage composition, differ from each other widely as to specific gravity, boiling point, and in the diffusiveness of their vapour. In the American oils, the members of the series having the lowest specific gravity and greatest volatility preponderate; in the oils obtained from the other sources mentioned above, the reverse is the case. The practical bearing of this state of things is, that oil obtained from the American petroleum is more inflammable itself, and

not only so, but, from its superior volatility, the vapour diffuses into the atmosphere at a comparatively low temperature. This vapour is inflammable, and, like all vapours of the kind, forms, with oxygen, a mixture not only inflammable, but explosive; and so it comes that many of these volatile hydro-carbons are unquestionably so far dangerous as to require for their use and storage very considerably increased caution.

At the same time, the outcry which has been raised against the use of these oils is absurd in itself and obstructive to commercial enterprise. It is, doubtless, right in principle that substances of such a character should be kept under the supervision of the law, and that persons carrying on trade in them should be compelled to adopt the necessary precautions as to storage, &c., when danger exists; but there seems to be neither reason nor justice in such a course as that taken by the legislature at the close of last session of Parliament, when a bill was passed,* prohibiting any merchant or manufacturer from holding in stock more than 40 gallons of petroleum, of *any kind,* without a license from certain authorised licensing bodies. There are petroleums which involve no more danger in their storage than sperm oil, which give off no inflammable vapour, excepting at a temperature closely approaching that of boiling water—as the Rangoon earth oil, for example. This substance, with the exception of the Boghead coal, forms the staple from which the illuminative oils and paraffine have been obtained. The rectified oils so obtained are exempt from the operation of the Act of Parliament, because they do not give off inflammable vapour under 100° Fahr.; but the raw material which does not give off inflammable vapour under from 205° to 210° Fahr., is brought under the vexatious operation of the Act simply because it is called petroleum, and without any consideration for its chemical and physical characters. By the words of this Act all the products of the distillation of the cannel coals—in every respect as dangerous in their nature as Rangoon petroleum—get off free. A score of substances, far more dangerous than either, are also left uncared for, and the Act becomes, therefore, partial in its operation, and mischievous, from the restrictions which it places upon manufacturers, where they are unnecessary, and altogether uncalled for.

T. W. K.

* An Act for the Safe Keeping of Petroleum (29th July, 1862).

ARGYLLITE; OR, THE SULPHO-VANADITE OF LEAD.—A NEW MINERAL.

In connection with the history of the mineral that forms the subject of the present article, it becomes necessary for me to mention a few facts associated with the discovery of the substance itself; and this I will endeavour to do as briefly as possible.

For some years past, a nickel mine has been worked by the Duke of Argyll, in the neighbourhood of the town of Inverary, in Scotland, and the successful working of this mine has naturally led to the formation of several "borings" or holes, made with a view to discover the extent and direction of the mineral deposits in the locality of the mine. From these borings many different kinds of minerals have been obtained, most of which have been submitted to me for analysis; and, as a general summary of the whole, I may say that they have consisted of mundic, or sulphuret of iron, mixed with various proportions of the sulphurets of copper, nickel, lead, and arsenic; and in one instance the mundic contained gold, or was what mineralogists call "auriferous pyrites."

In the early part of this last summer, the Duke of Argyll happened to be at Inverary during the time at which some mineral matters of an unusual appearance were obtained from the borings, and, mixed with these matters, his Grace at once detected a substance of a crystalline form, that possessed the peculiar power of reflecting light, technically termed "glance." The quantity of this substance was extremely small, for it existed merely as a thin incrustation upon the mass of the mineral matters. A portion of the mineral was, however, sent to me, and I had no difficulty in ascertaining that the crystalline substance contained a metal, either altogether unknown, or of an extremely rare character, and that it greatly resembled vanadium; but the quantity of the mineral at my disposal was not sufficient to decide its nature. Under these circumstances, the Duke kindly sent me a larger supply of the mineral, by which I was enabled to demonstrate that the great mass of the matters consisted of copper pyrites, mixed with galena, and coated here and there with a thin semi-crystalline covering of the mineral first detected by his Grace, and which proved to be composed of lead, vanadium, and sulphur—a combination never before noticed. The crystals were, for the most part, imperfect and very small; but, by the aid of a microscope, I found that they were twelve-sided crystals or dodecahedrons.

In this condition the subject seemed likely to remain, when, by mere accident, I discovered a more abundant source of the same mineral, the

value of which may prove very great, if ever it can be obtained in large quantities. Upwards of twenty years ago, I visited Swansea, to ascertain, in a practical way, whether metallic iron could or could not be profitably used in the reduction of copper ore—that is to say, whether the copper, united to the sulphur in the ore, could not be displaced and set free by an equivalent of iron. The answer to this practical question was decidedly in the negative: the scheme was a failure. But my time was not lost, for, in addition to much valuable information, I then obtained an immense number of specimens of copper ore, from almost every part of the world, and one of these is the identical specimen by which I have been enabled to complete this inquiry, and which indicates, in fact, the "abundant source" above alluded to. The specimen is a sample of copper ore from a mine then worked near Fowey, in Cornwall; and there was this singularity about the Fowey ore, that it required to be reduced apart and separate from the other ores employed at the Swansea works; for the copper which it yielded would not roll into sheets, and even destroyed the malleability of the other copper, if mixed with it. This defect had not any connection with the subject of my present inquiry, and I have mentioned it only for the purpose of characterizing the ore, so as to facilitate its subsequent detection in a commercial point of view. Chemically speaking, the ore consisted of copper pyrites, the cracks and cavities in which were almost filled with well-formed crystals, having the general aspect of galena, but with this unusual quality attached to them—that they were all, without exception, rhombic dodecahedrons. The existence of dodecahedral galena is not, perhaps, altogether an impossibility; but, at any rate, it would be a very great curiosity, and, as such, I had long preserved this Fowey ore, and even exhibited it to many of my mineralogical friends, when a microscopic examination of the ore sent me by the Duke of Argyll recalled to my mind the dodecahedral form and subdued *glance*, or rather *glimmer*, of the Fowey crystals.

A single experiment at the blow-pipe served to convince me that these crystals contained vanadium, in addition to the ordinary components of galena, and therefore I immediately separated the whole of them from the ore, and subjected them to a careful analysis, of which the following is a *resumé*:—

The form of the crystals is a rhombic dodecahedron, and the facets are covered with striæ, so as to produce a slight iridescent tarnish; therefore it is clear that the dodecahedral is a secondary form, and I am inclined to think that the primary form is an octahedron, for although the crystals are too small to admit of cleavage, yet the direction of the striæ favours the above conclusion. The specific gravity is 6·04; the color a dark lead-grey, with considerable lustre; the hardness

greater than galena; the powder black and opaque. Before the blowpipe it decrepitates slightly, and on charcoal yields, with soda, a globule of lead, surrounded by a greenish-yellow ring; with borax, and also with microcosmic salt, it affords a fine blueish-green bead in the reducing flame, and this color gradually diminishes to a greenish-yellow, if kept long in the oxidizing flame: in both cases, the bead is of a red color whilst hot. By boiling nitric acid, it is readily acted on, and then affords a bright blue solution, from which a white powder precipitates, at the same time that globules of sulphur float on the surface.

Its composition is as under:—

Lead	60·5
Vanadium	20·8
Sulphur	18·7
	100.

It is therefore composed of two atoms of the sulphuret of lead, united to one atom of bisulphuret of vanadium; so that it bears a strong class resemblance to bournonite, jamesonite, and berthierite, which are compounds having the sulphuret of antimony in place of the sulphuret of vanadium, and this is united to a basic sulphuret, either of lead, copper, or iron: the new mineral also resembles tennantite, in which the lead and vanadium are replaced by copper and arsenic, but in which exactly the same crystalline form occurs. In accordance with the usual system of nomenclature, I have named it after its first discoverer, Argyllite; it is, however, a basic sulpho-vanadite of lead, and, if it can be procured in large quantities, promises to be of great commercial value; for I have been informed, upon excellent authority, that the beautiful dark blue color which vanadium forms with tanno-gallic acid, has recently been fixed upon silk by means of a newly-discovered mordant, and the result is not less admirable for the stability than for the beauty of the tint: the only difficulty hitherto has been to procure a supply of the metal equal to the anticipated demand. It is not improbable that the small quantity of vanadate of lead found coating the calamine and other minerals, at Wanlockhead, may have been originally produced by the action of the air and water upon the Argyllite, and the resemblance of this substance to galena may frequently have induced the miners to neglect or reject it, as too insignificant for their purposes, under belief that it was merely galena.

By way of conclusion to this paper, I will mention a circumstance that has already been of great utility in one instance, and may, perhaps, be so in many others, when it is generally known. Some years since,

I was applied to by a person, then on the point of emigrating to the gold mines of Australia, for a simple, easy, and decisive means of detecting the gold contained in auriferous pyrites, that would enable him at once to form an opinion of the value of the mineral. To assay this substance is not difficult, but requires a furnace and a long round of tedious operations; then again, the color and general aspect of gold and pyrites are so much alike, that even with a lens the one cannot be distinguished from the other, when they are mechanically mixed, as in auriferous pyrites. I devised, however, a mode adapted to his requirements, and with this method he started for Australia, from whence he has lately returned, a perfectly independent—in fact, a rich—man. How much of his success is due to the method I will not say, though he himself ascribes much to it; but I leave others to judge for themselves. The experiment once seen, is certain to leave an impression that no time can efface, and is as follows:—

Having provided a common tea cup or other similar vessel, cut a piece of card into a circular form, and of such a size that it will rest midway in the tea cup: then take a small piece of the pyrites recently broken, and make a hole in the centre of the card, just large enough to admit and retain the pyrites: now put into the tea cup a small quantity of quicksilver, about the size of a four-penny piece, and place the card in the cup, so that the pyrites may rest a short distance above the quicksilver: next place the whole upon the hob or other warm (not hot) situation, and so leave it for half an hour: at the end of this time examine the surface of the pyrites with a lens, of the kind used by watchmakers, and which are sold in London for sixpence or a shilling each: the particles of gold will now be of a white color, as if frosted over, and if the whole be rubbed with a camel's hair pencil or the top of a quill, the gold will assume a brilliant appearance like a mirror or the surface of a piece of newly-polished silver, whilst the rest of the pyrites will remain unaffected. It is then easy to judge of the comparative value of the ore.

LEWIS THOMPSON, M.R.C.S. &c.

Recent Patents.

To Brereton Todd, *of Bissoe and Perran Smelting Works, near Falmouth, for improvements in the manufacture of antimony and the oxide of antimony.*—[Dated 17th March, 1862.]

This invention consists in burning the sulphide of antimony or the oxisulphide of antimony, by throwing it on a fire in a furnace, or by mixing it with a carbonaceous substance, and burning it in a crucible, retort, or furnace, and causing the ascending vapours to pass with a current of air through flues or condensers, by which process all the antimony contained in the ore will be deposited in the said condensers or flues in the state of oxide, and the sulphur volatilized in the state of sulphurous acid gas.

The most simple mode of working the invention is to use a furnace built like a chimney, with a flue leading from the top of it to a set of flues or condensing chambers. The door for charging the fuel and substance containing the antimony ought to be about three feet from the ground; and openings are to be left at each side, at the bottom of the furnace, for giving air and drawing out the refuse. The furnace may be about eight feet high, as the most convenient for working. Crucibles and retorts may also be employed in place of furnaces, so long as the furnaces, or crucibles, or retorts employed are in connection with flues or condensing chambers, and the substance to be worked containing the antimony is mixed with a carbonaceous substance.

To manufacture the oxide of antimony in a furnace such as is above described, a fire is to be lighted therein with coke, and, after it has burnt up to a red heat, the substance containing the antimony is to be gradually thrown on the fire,—regulating the charge so as to allow only sufficient air to pass through the furnace to keep up the combustion and carry off the vapours as they arise to the flues or condensers. The charging of the substance containing the antimony is to be repeated from time to time, as the antimony oxide volatilizes, and the fire is to be kept at a regular height by the addition of coke, as required. The refuse is to be drawn out at the bottom of the furnace, as soon as it has ceased to give off any smoke. After all the substance containing the antimony is worked, the oxide of antimony will be found deposited in the flues and condensing chambers connected with the furnace.

Any sulphur that may have been associated with the substance worked will have been carried off by the draught through the condensers, either in the state of sulphurous acid or bisulphide of carbon, according to the heat of the fire used.

In cases where the oxide of antimony, obtained by the above or other process, requires to be purified and obtained in a white powder, it is submitted to the above described process. The oxide of antimony is converted into antimony metal by ordinary means.

The patentee claims, "the production of the oxide of antimony by the above described process, and also the purifying of the oxide of antimony, obtained by the above or other process, by volatilizing it in the manner above described."

To Francis John Bolton, *of Bolton-row, Mayfair, for improvements in rifle and gun stoppers and oil bottles.*—[Dated 11th February, 1862.]

This invention relates to an improved mode of constructing a rifle or gun stopper, so as to combine in one article a gun or rifle stopper, and an oil bottle, with pricker or oil pin.

In Plate X., fig. 1 is a vertical section of the improved stopper, and fig. 2 represents the stopper in the metal sheath D, which is provided with a strap *a*, whereby the sheath may be attached to the accoutrements. The cylindrical metal tube A, fig. 1, forms the body of the stopper, and, being hollow, is made to contain oil, and therefore will act as an oil bottle as well as a muzzle stopper. The cylindrical case A, is screwed or otherwise fastened into the head piece or block *b*, which, being made with a flat top, admits of the stopper standing thereon on a table in a vertical position, as before mentioned. The cylindrical tube A, is covered externally with a case C, made of woollen or worsted felt or cloth. Tubular coverings of worsted cloth, of considerable substance, and woven in the form of a tube, with a thick ribbed surface, forms the best and most suitable covering, and as it possesses a considerable amount of clasticity and porosity, it will fit the grooves of the rifle, and will keep moist with oil for some time, so that the muzzle of the rifle will always be kept well oiled. This ribbed covering can also be applied with great facility; as the ends of the tubular cover can be easily secured to the metal case A, by the screwed ends of the latter, as shown in fig. 2. The oil pin or pricker B, is composed of three wires, brought close together at their points, so as to hold a drop or two of oil. These wires are secured in a brass end piece *d*, which screws into the open end of the oil bottle or cylindrical metal case A.

The patentee claims, "the general arrangement and construction of parts constituting a tubular rifle, and gun stopper, and oil bottle, with elastic outer covering, and case or sheath, as herein set forth. Also the oil pin or pricker, constructed as described."

To Joseph Whitworth, *of Manchester, for improvements in manufacturing and preparing projectiles, and in apparatus to be used for those purposes.*—[Dated 25th February, 1862.]

This invention relates to giving projectiles the required regularity of shape, by placing the projectile in a chuck, and turning the fore and rear parts simultaneously, or by consecutive operations, without removing the projectile from the chuck in which it is held. For this purpose a machine is employed having a holder or chuck, in which the projectile is held in the middle or intermediate of its length, and the machine is arranged so that the chuck may be made to revolve, and so that the tools which produce the required shapes to the ends may be moved up to and from the fore and rear parts, respectively, of the projectile: or the projectile may be held and presented to revolving tools.

Fig. 1, Plate IX., shows a front view of a machine, as above described, arranged to turn the fore and rear parts of a projectile, either simultaneously or by consecutive operations, without removing the projectile

from the chuck in which it is held. This machine is more especially applicable for producing polygonal projectiles suitable for small bore rifles.

A, A, is the frame of the machine, carrying a standard B, in which revolves a conical chuck C, driven by a band passing around the pulley C^1; the said conical chuck carries a die *a*, which holds the projectile *b*, to be operated upon, which has previously been brought to the proper diameter and exterior form (excepting as respects its fore end) by pressure in dies; the fore end of the projectile and the hollow at the base has also previously been by preference approximately formed by pressure. D, D, are two slides, which carry cutter blocks d^1, and d^2: the cutters d^3, d^3, which are simply knives or blades of steel sharpened at the edge, are so formed as to give the required shape, as is shown, to the ends of the projectile. F, F, are two hand levers, turning on axes at their lower end, and carrying studs entering between collars G, G, on the slides D, D, so that these may be forced up and withdrawn by means of them. The collars G, G, are adjustable to suit the required length of the projectile. The projectile is put into the die *a*, and removed therefrom by hand, the die fitting it with moderate tightness. If it be desired to turn cylindrical projectiles, the die *a*, should be split or made in two parts, which are drawn together by means of a conical bearing into which the die is forced, and so the projectile is held firmly whilst it is being turned.

In applying to projectiles suitable lubricating materials, a portion of the surface is coated with the lubricator, applied in spiral strips or ribs, that is to say, those parts are coated, or more thickly coated, which, when the projectile is in the rifled barrel, correspond with its grooves or recesses, by which means provision is made for easy loading without greatly reducing the diameter of the projectile. The projectile may be covered with paper or a thin metallic or other suitable coating, to prevent the barrel from leading, and in that case, the lubricator is applied, or more thickly applied spirally, upon the covering material.

In carrying out this part of the invention, an instrument is employed, such as is shown in side view at fig. 2. It consists of a piece of metal bored and rifled internally in the same manner as the rifle from which the projectiles are to be fired. Into this the projectile previously, by preference, covered with paper, as is usual, is introduced at the top, and pushed down to the lower end of the instrument till it occupies the position in which it is shown in the drawing, where it is marked *a*. The apparatus is slotted at *b*, *b*, and is, with the bullet within it, dipped into melted beeswax or other suitable lubricator, which, entering through the slots, coats the bullet at the parts which do not come in contact with the bore of the instrument, so that the bullet, when pushed out by the way it entered, is found to be lubricated as required. *c*, is a plug, which is employed to prevent the lubricating material entering the hollow at the base of the projectile.

In some cases, in place of employing the instrument shown at fig. 2, the exterior of the bullet is coated by dipping or otherwise, and the lubricant is afterwards removed from the parts where it is not required.

Fig 3 is a plan of a die with adjustable scrapers employed for the purpose above mentioned. *f*, *f*, are small blades or scrapers; they are adjusted by means of the small screws and slots *g*. The projectile, after being dipped into the lubricant, is forced through the die and scrapers *f*, which take off the superfluous lubrication.

When paper or similar covering is used, the end of the paper is twisted into the recess against the resilient material in the rear end of the projectile, and by causing the projectile to revolve in a lathe or other suitable machine, the end of the paper is concentrically twisted and pressed into the recess against the resilient material by suitable tools, such as a piece of boxwood, with a conical recess at one end; and before or at the time the covering is put on, suitable resilient materials, made of fibrous or other elastic substances, are inserted into the recess: this is done in order that the paper or other covering may be quickly and uniformly detached from the projectile in such a manner as not to interfere with its flight. The resilient material found to answer the purpose is made by cutting and chopping blotting paper into small pieces, and then rubbing it until it becomes a dry pulp. Finely-curled hair, made into small spheres, also answers the purpose. Fig. 4 is a section of a projectile with the resilient material within it.

To JOHN BELLAMY PAYNE, *of Chard, Somersetshire, for improvements in the treatment or preparation of hemp, flax, and other analogous fibrous substances for spinning.*—[Dated 5th February, 1862.]

THIS invention of improvements in the treatment or preparation of hemp, flax, and other analogous fibrous substances for spinning, has for its object to loosen and soften the woody and gummy matters that naturally adhere to, and form part of, the crude plant, so that when these extraneous matters are removed, and the fibres softened by the operations to which they have been subjected, the useful fibres may be employed for the manufacture of rope, line, twine, cord, or other articles for which they may be applicable.

The invention consists in submitting the crude fibres to the action of steam and friction at the same time, by means of rollers, stampers, or other equivalent mechanical contrivances; jets of steam being admitted at the same time, and caused to act on the fibres, and thereby assist in or facilitate the detachment of the extraneous matters, and at the same time soften the fibres.

In Plate X., fig. 1 is a longitudinal vertical section of the improved apparatus. *a, a,* is a case in which the fibrous material to be operated upon is to be placed. The bottom and sides of this case are lined with corrugated, roughened, indented, or toothed metal friction plates a^*, a^*, against which the fibrous material is rubbed by the action of the beaters *d*, hereafter mentioned, and is thereby submitted to considerable friction. Part of the bottom of the case *a*, is formed of a steam chest a^1, which is supplied with steam or hot water from any suitable boiler, and is covered with a plate of copper and another of lead, with a layer of felt between them. By this combination of plates of copper and lead, with a sheet of felt between them, a bed is obtained, possessing a certain amount of elasticity, and one that is also capable of holding and tempering the heat given off from the steam chest a^1. A perforated steam pipe *b*, is also let into a suitable recess at the bottom of the case, and steam is injected therefrom into or on to the mass of fibres in the case while the material is being submitted to the friction of the beaters. The back part a^2, of the case *a*, is made moveable on a hinge, and is adjustable so that it may be

moved into a forward or backward position on such joint by means of the screw adjustment c, shown detached in plan at fig. 2. The screw c, passes through a nut in a cross-head c^1, fixed in jointed arms attached to the moveable part of the casing, and this moveable part a^2, is secured in any desired position by means of a click or pall, which takes into the ratchet wheel c^3, on the end of the screw c. Hollow beaters d, d, provided with indented or roughened surfaces, both at their faces, backs, and sides, are secured on the end of arms, which are mounted on pivots d^1, at the upper end of the vertical standards e. A tappet wheel, provided with tappet arms, is mounted below the projecting ends of the beater arms, and as the tappet wheel rotates, it will lift up the beaters, and allow them to fall upon the raw flax or other fibrous material that is placed in the apparatus. Openings g, g, are made in the sides of the case a, to allow the dust from the fibres to pass off. This beating action creates a considerable amount of friction, and, in addition to this, steam is injected from the perforated pipe b. By the combined operation of the beaters with the steam and heat, the woody parts of the plants are detached from the useful fibres, and the latter are rendered soft and brought into a proper state for the subsequent operations of heckling, combing, and spinning. As different fibres require a somewhat different treatment, the roughened or indented surfaces a^*, a^*, are arranged and adapted to the inside of the casing in such a manner that they may be removed with facility, and changed for other plates having roughened or indented surfaces of a different or modified character.

The patentee claims, "the mode, herein set forth, of treating and preparing hemp, flax, and other analogous fibrous substances, and also the general construction of the apparatus shown and described, when applied to the purposes of the invention."

To GUSTAV LINDEMANN, *of Manchester, for improvements in applying gas for the purpose of singeing or dressing yarns or threads, and woven fabrics, and for obtaining heat for other purposes.*—[Dated 11th February, 1862.]

THIS invention consists in submitting yarns or threads and woven fabrics to the action of the flame of gas, which is caused to rotate by giving an axial motion to the burner; the revolving flame is also applied to surfaces used for drying, or to other purposes where heat is required.

In Plate X., fig. 1 represents in section, a machine to be used for singeing or dressing woven fabrics; and fig. 2 is a view of the revolving burner detached. Upon a framework a, are mounted rollers b, c, over which the material passes in the direction of the arrows, as shown by the dotted line: within a space partly enclosed by the rollers c, is a hollow cylinder d, the periphery of which is provided with a number of slits, upon which the gas burners e, are mounted. The end f, of the axis of the cylinder d, turns in a bearing; the other end g, is hollow, and also turns in a bearing, beyond which the said axis extends, and passes into a stuffing box, the part z, thereof being provided with a gas supply pipe z^1. When, therefore, the gas is turned on, it fills the cylinder d, and issues from the long strip-like burners e. Upon the axis of the cylinder d, is a small pulley driven by a band from the shaft h, and thus a rotatory flame is

produced, which, as it revolves, plays upon the material during its passage through the machine. The arrangement of rollers *b*, *c*, constitutes no part of the invention, and they may be caused to revolve so as to carry the material through the flame by any ordinary means, their speed being regulated according to the rapidity with which the material is to travel, as is well understood.

Fig. 3 represents a polygonal instead of a cylindrical revolving gas chamber, provided as before with burners *e*.

The invention may also be applied to apparatus for drying woven or other such fabrics, in which the improved revolving gas burner, applicable for such purpose, is shown at figs. 4, 5, and 6. The burners, formed as before in long slits, are at *e*, mounted or formed upon pipes *d*; these pipes are carried by end pieces *m*, and are connected in the middle by a chamber *n*, which communicates, by means of openings *o*, with the interior of the said pipes. On each side of this chamber is a boss *p*, attached to the pipes *d*, and carrying on one side a solid axis *f*, and on the other side a hollow axis *g*. The latter runs in a bearing provided with a stuffing box, and a pipe leading from the gas supply as in fig. 2, which gas can therefore flow into the pipes *d*, and from them to the burners *e*. Upon the axis *g*, is a pulley *f*, which, by being driven from the motive power, causes the gas burners to revolve during the burning of the gas, and thus heat is generated, which passes through a gauze cylinder *k*, within a cylindrical casing, in which is placed the fabric to be dried.

Fig. 7 shows at *d*, another form of pipe that may be used instead of the cylindrical tubes.

Figs. 8 and 9 show the burners to be applied to apparatus for boiling fluids. The vessel to contain the fluid to be boiled is provided with a series of pipes placed in an annular form, and surmounted by a dome, and on the inside of these pipes is a conical chamber, enclosing the revolving gas burners constructed as follows:—At *f*, is a pipe constituting an axis, which runs in a bearing, provided with a stuffing box or other suitable apparatus, for allowing gas to flow into the said hollow axis from a pipe connected with the gas supply. This axis *f*, is connected to a hollow ring *w*, by a pipe *v*, from which there extends a series of pipes *d*, provided with burners *e*. The axis *f*, is driven by a pulley, or by other suitable means, and the burners, therefore, are caused to revolve. At *x*, is a shield, for causing the air to enter at the inside of the burners.

The patentee claims, "the use of a revolving gas burner or burners."

To JOHN HETHERINGTON, *of Manchester, for improvements in machinery or apparatus for preparing cotton and other fibrous materials for spinning.*—[Dated 11th February, 1862.]

THIS invention refers, firstly, to the scutcher, and consists in fluting or corrugating the edges of the blades thereof. This part of the improvements is shown in Plate IX., at fig. 1, which represents, in cross section, that portion of the scutcher to which the invention refers. The blades of the beater are shown at *a*, on each side of which there are grooves or flutings.

Secondly, the invention refers to the carding engine; one improvement in which consists in working the doffer comb by two excentrics, and this

part of the apparatus is constructed by casting one of such excentrics upon the shaft. This improvement is shown at fig. 2, in which *a*, is a shaft, deriving rotatory motion from the pulley *b*: on the shaft *a*, are two excentrics *c*, *d*, the former of which is made as a separate part, and is confined between the bearing *e*, and a plate *f*, fixed to the shaft *a*. The other excentric *d*, is cast upon the shaft; and the strap, after having been slipped on, is confined between a boss *g*, and the pulley *b*. The rods proceeding to the doffer comb are shown at *h*.

Another improvement in the carding engine relates to those arrangements in which hinged tops or flats are employed, and consists in mounting them, together with the adjustments for "heeling" in one fixing, so that the whole may be moved bodily. This part of the invention is shown at figs. 3 and 4. The "bend" of the carding engine is at *a*, to which are adapted bolts, passing through slots in the brackets *c*, which brackets are therefore capable of being raised or lowered, and of being fastened in any desired position by the nuts *d*. The flats are at *e*, mounted upon centre pins *f*, which are carried by the brackets *c*, and upon these centres, therefore, they may be turned over, as is well understood. Upon the brackets *c*, are arms *g*, provided with pins *h*, constituting stops for determining the heeling of the flats. It will be seen that, by this arrangement, the brackets *c*, when raised or lowered, will carry with them the pins *h*, and, consequently, that when the correct heeling has once been obtained, it will remain so for all elevations of the flats.

Thirdly, the improvements relate to the drawing frame, one part thereof consisting in the application of two trumpets, through which the sliver is caused to pass, one of such trumpets being employed for the stop motion: also, in the drawing frame, the part which carries the lever of the stop motion is so constructed that it shall bear the trumpet thereof in an elevated position when the sliver is to be adjusted. These two features of the invention are shown at fig. 5. The usual calender rollers are shown at *a*, above which is a trumpet *b*, not connected to the stop motion, but carried by a plate *c*. The trumpet of the stop motion is at *d*, mounted upon a lever *e*, which has a knife edge *f*, resting upon a standard *g*. The other end of this lever is provided with a step *h*, which falls when a sliver breaks, so as to intercept the reciprocating blade *k*, and arrest the motion of the machine, as is well understood. At *l*, is another step upon the lever *e*, which arrives when the sliver breaks, as just mentioned, upon the plate *m*, whereby the said lever is prevented from turning downward beyond a certain distance. At *n*, is a pin projecting from the lever *e*, and extending beyond the slot *o*, within which the lever moves. When it is desired to adapt the sliver to the rollers *a*, the lever *e*, is drawn forward, and the knife edge *f*, thereof is placed upon the part *g**, of the standard, so as to assume the position shown by dots, and the inward end will then be supported by the pin *n*, resting upon the plate *m*.

The patentee claims, "Firstly,—fluting or corrugating the ends of the beaters of scutching machines. Secondly,—the use of two cranks for actuating the doffer combs of carding engines; one of such cranks being cast upon the shaft. Thirdly,—in carding engines, mounting those tops or flats which turn upon hinges, and the apparatus for heeling, so that they may be moved bodily. Fourthly,—in reference to the drawing frame, the application of two trumpets, through which the sliver passes, one of them being employed for the stop motion. And lastly,—in the

drawing frame, the provision for bearing the trumpet lever in an elevated position."

To THOMAS WATSON *and* ROBERT DRACUP, *both of Thornton, near Bradford, Yorkshire, for improvements in means or apparatus for preparing and combing wool and other fibres.*—[Dated 25th February, 1862.]

IN apparatus for preparing and combing wool and other fibres, such fibres are operated by teeth in bars, or instruments, to which a progressive motion is given by the simultaneous movement of pairs of toothed wheels; but it sometimes happens that through such wheels being rigidly fixed to their shaft, and some obstruction arising, either in the fibre treated, or in the working of the mechanism, breakage takes place. Now the object of this invention is to remedy this evil, by connecting such wheels to their shaft, so that whilst uniformity of action may be secured, a yielding may take place when any undue obstruction arises. For this purpose the bosses of such pairs of wheels are connected together by a bar or bars, or other suitable connecting means, and a strap or collar is applied to embrace the shaft, and the amount of adhesion is adjusted thereto by set screws or other suitable means capable of adjustment to the pressure ordinarily desired to be exerted.

In Plate IX., fig. 1 shows, in plan view, apparatus such as is employed in preparing and combing wool and other fibres by the use of what are called gill combs. *a, a,* are the gill bars, which are set with teeth or combs, and are progressively moved by the action of the screws *b, b,* upon the ends of such bars. These screws are formed on or affixed to axes *c, c,* which turn in bearings *d, d,* carried by parts of the main framing *e, e,* and they have affixed upon them the bevilled pinions *f, f*; and in order to the simultaneous motion and uniform speed of the axes *c, c,* the teeth of these bevilled pinions *f, f,* are taken into by the teeth of corresponding bevilled pinions *g, g,* upon the axis *h.* But according to this invention, these wheels, *g, g,* in place of being rigidly affixed to their shaft *h,* are connected together by bars *i, i*; these bars are connected to the collar *j,* and the collar *j,* is held in position on the shaft *h,* by means of the cotter *k,* aided by the adjustable screw *l,* as shown at fig. 2, in order thereby to obtain an adjustable amount of adhesion to the axis or shaft *h,* adapted to ordinary working, but which will admit of the parts so connected yielding without breaking them or other of the parts when undue obstruction arises.

The patentees claim, "the adaptation of means to the gearing wheels, operating bars of combs or gill teeth in apparatus for preparing or combing wool and other fibres, substantially as explained."

To WILLIAM CLISSOLD, *of Dudbridge Works, near Stroud, Gloucestershire, for improvements in carding engines.*—[Dated 25th March, 1862.]

THE object of this invention is to facilitate the adjustment of the bearings of the strippers and workers of carding engines. Hitherto they have generally been adjusted laterally by means of clamping screws, tapped into projections on the side frames of the engine, or screws coupled to

the bearings have been held fast by binding nuts to lugs on the frames; the screws in each instance acting in a line with the adjustable motion of the bearings.

As an improvement on these modes of adjustment, the patentee employs the arrangement shown in Plate IX., in which fig 1 is a side view of a bearing, with the novel means of adjusting it, as seen from inside one of the side frames of a carding engine, and fig. 2 is a sectional plan view of the same. In these figures, A, A, is a portion of one of the side frames of the carding engine, and B, is the worker or stripper roller, carried by a pair of arms, one of which is shown at C. These arms are formed, as is usual, with the bearings at their outer ends, to receive the journals of their respective workers or stripper rollers, and are slotted at their lower ends, for the purpose to be presently explained. Above the slot the sides of the arms are chamfered, to allow of their being embraced by a pair of wedge-shaped clamps D, D, These clamps are carried by screws *d, d,* which project inwards from the outer face of the frame A, and they are confined between guides *a, a,* over which they slide, cast on or otherwise attached to the inner side of the frame. From this explanation of the construction of the parts for holding the arms C, in position, it will be readily understood that, by simply slackening one clamping wedge D, and tightening up the other, the lateral adjustment of the arm and the bearing forming part therewith, will be effected.

For obtaining the vertical, or more properly speaking, the radial, adjustment of the workers or strippers, a radial screw E, fitted with two collars, is provided, which embrace the lower end of the slotted bearing C. This screw is tapped into the side of a clamping pin F, which projects through the slot in the arm C, and is secured to the frame A, by a fulcrum screw *f.* Before any adjustment of the stripper bearing can take place, the clamping guide pin F, which serves to hold the arm C, fast to the frame of the engine, must be slackened by unscrewing the fulcrum screw *f.* Then by turning the screw E, which is tapped into the guide pin F, either to the right or left, the required adjustment of the worker or stripper, either to or from the carding cylinder, will be readily effected. In like manner the slackness of the clamping guide pin F, allows of the wedge clamps being operated with facility by their screws *d, d,* to effect the lateral adjustment of the roller. The fulcrum screw being now again tightened, the bearing will be firmly held in position.

The patentee claims, "adjusting the bearings of strippers and workers in the manner above described."

To JAMES EDWARD McCONNELL, *of Wolverton, Buckinghamshire, for improvements in railway breaks, and in warming railway carriages.*—[Dated 13th February, 1862.]

THIS invention relates to that system of railway breaks wherein the breaks are applied simultaneously to any or all of the carriages in the train, and consists in the use of a force pump, situate in the guard's van, or other vehicle forming part of the train, and worked either by the guard, or by the engine, or by excentrics on the axles of the tender or van, for the purpose of forcing air or water into pipes extending along the entire train, and connected at suitable intervals with horizontal cylinders placed between

the pairs of wheels in each carriage, such cylinders being provided with pistons, which, through the action of the force pump, will apply the break blocks directly to the wheels or axles simultaneously throughout the whole train. These breaks may also be worked by steam pressure from the boiler, if desired. The pipes above referred to may serve to warm the carriages, by passing steam or hot water through them from the boiler.

In Plate X., fig. 1 represents a vertical section of a portion of a carriage and guard's van, with the improved break actuating mechanism attached; and fig. 2 represents an elevation of a modified arrangement for working the breaks. *a*, represents an ordinary passenger carriage, and *b*, the guard's van. Along the framing of each carriage in the train, and to the van and tender and engine, is attached, in any convenient manner, a pipe *c*, these pipes being coupled together, when the train is made up, by any simple mode of coupling—a short length *d*, of flexible tubing being employed for connecting the ends of the several pipes. A small force pump *e*, is fitted inside the van, or on the tender or engine, and is worked by an excentric *f*, fast on one of the axles, as shown, or simply by the hand of the guard, if preferred. This pump is in communication, by means of a pipe *g*, with a water tank placed in or under the van, or with the tank of the tender, as the case may be. A second branch pipe *h*, connects the pump with the series of pipes *c*, running along the framing of the several carriages. *i*, is a third branch pipe, which is connected, by means of a two-way cock at *k*, with the branch *h*, and communicates back with the water tank again. A small cylinder *l*, bolted to a bracket secured to the framing, or otherwise attached thereto, is placed between any two of the wheels, on any or all of the carriages of the train. This cylinder is provided with two pistons, the rods of which pass through stuffing boxes, on the opposite ends of the cylinder, and are connected, either directly or by the intervention of links or connecting rods, with the break blocks *m*, *m*. The cylinders are connected with the water pipes *c*, by means of short branch pipes *n*. A safety pipe *o*, is also connected with the pipe *c*, or with the force pumps, for the purpose of allowing of the escape of the liquid, should the pressure inside the pipes and pumps become so great as to incur the risk of bursting them; a safety valve *p*, properly weighted, being fitted to the top of each pipe *o*. One of these safety pipes and valves will be placed in the guard's van, and another on the tender, and the valve lever of each is connected, by a cord or otherwise, with the hammer of a gong or bell, or other alarm or signal apparatus, for the purpose of signalling when the full pressure is on and the breaks applied; the lifting of the valve lever causing the signal to be sounded, and indicating the application of the breaks to the guard or to the engine driver, as the case may be.

The following is the mode of using this break apparatus:—The train having been made up with the van behind, or with one or more vans in different parts, each provided with a duplicate arrangement of forcing apparatus, and the pipes *c*, *c*, all tightly coupled with the short flexible pipes *d*, the whole length of the pipes, and the several cylinders, are filled with water, by a few strokes of the pump, on starting the train. So long as the breaks are not required to be in action, the two-way cock *k*, is so turned as to shut off the pipes *c*, from the force pumps, and at the same time to open the communication through the branch *h*, into the water

tank; consequently, although the pumps are at work as the train proceeds, the water will merely be pumped out of the tank and back again, through the branch *h*; but when it is necessary to apply the breaks, the two-way cock *k*, is reversed by the guard or driver; thereby shutting off the return branch *h*, and establishing a direct communication with the pipes *c*, and, through them, with the several cylinders *i*, along the train. The pressure against the pistons in these cylinders causes them to move outwards simultaneously, and so force the break blocks firmly against the wheels, or against special break discs or drums, fast on the axles. So soon as the break blocks are driven home, the pressure inside the safety pipe will raise the valve, and, by displacing the lever, cause a signal to be given, which will notify to the guard or driver the fact of the breaks having been applied. The pressure is removed by reversing the two-way cock *k*, so as to bring the pump into direct communication again with the water tank or tender, through the branch *h*, and, if found requisite, weighted levers, or other convenient arrangement of mechanism, may be employed for taking off the breaks.

The modification of the cylinder, shown in fig. 2, illustrates the application of a single piston and rod to each cylinder, in lieu of two pistons. In this case, the rod of the piston works a lever *a**, centered at *b**, on a supporting bracket, and connected on opposite sides of its fulcrum with the rods or links *c**, *c**, which actuate the break blocks. It is obvious that either liquid or air may be forced into the pipes and cylinders, or, in lieu of having a mechanical forcing apparatus, the breaks may be actuated by admitting steam into the pipes direct from the boiler. This latter system will admit of the warming of the several carriages, by having branch pipes *q*, *q*, (fig. 1) passing across the carriages, under the seats, or in any convenient and suitable part of the carriage. A steam chest *r*, may also be laid upon the carriage floor, and supplied with steam from the pipes *c*, so as to form an effective foot warmer. Suitable cocks are provided in convenient places for shutting off the steam from any one or more of the carriages as desired, without interfering with the action of the break mechanism.

The patentee claims, "First,—the general construction, arrangement, and combination of apparatus or means for working any number of breaks simultaneously throughout the entire length of a train, substantially as described. Second,—the general combination of steam pipes and appliances for warming railway carriages, substantially as described. Third,—the application and use of the safety pipes and valves, in combination with signal appliances, for the purpose of preventing undue pressure, and of intimating the application of the breaks to the guard or guards, or engine driver, as described."

To JAMES PETERKIN DOUGLAS CAMP, *of Fleet-street, for improvements in the arrangement of valves for steam and other engines, and in the means of operating the same,—being a communication.*—[Dated 22nd February, 1862.]

THIS invention is more especially intended for direct-action steam engines for pumping, blowing, and other purposes, for which a reciprocating motion is required, and no rotary motion is necessary. It consists in a

peculiar arrangement of parts for operating a secondary valve for admitting steam to act upon pistons to complete the movement of the main valve after its movement has been partially accomplished by a connection with the main piston rod.

In Plate IX., fig. 1 is a vertical longitudinal section of the principal parts of an engine with the invention applied thereto; and fig. 2 is a plan of the machine, with the valve chest in section. A, is the engine cylinder; B, the piston: C, the piston rod; and D, the valve chest, having attached to it at opposite ends two short cylinders E, E^1, standing in line with each other, and parallel with the main cylinder A. These cylinders E, E^1, are open to the valve chest at their inner ends, but closed at their outer ends, except that the cylinder E, has a stuffing box C^1, for the passage of the valve rod F. G, is the main valve, which is of the kind known as the short "three-port" valve, and a, a, is its seat, having the usual arrangement of steam ports b, b^1, and exhaust port c. At the side of the valve seat a, and either parallel or in the same plane with it, is the seat of the secondary valve H, which is like the main valve G, only narrower, and works over a system of ports d, d^1, e, which are arranged and spaced like b, b^1, c, as shown in fig. 2, but narrower, as they are required for the passage of a very much smaller quantity of steam. The ports d, d^1, communicate by passages h, h^1, with the outer ends of the cylinder E, E^1, and the port e, communicates with the main exhaust port c, or is in any other way brought into constant communication with the exhaust pipe. The cylinders E, E^1, are fitted with pistons I, I^1, one in each cylinder, the inner ends of which are always exposed to the pressure of steam in the valve chest; the said pistons being rigidly secured to the valve rod F. The secondary valve H, is connected with the rod F, by a pin f, secured to the rod, and entering between two lugs g, g^1, on the back of the valve, or any other means by which the said valve can be operated without any lost motion relatively to the rod. The main valve is connected with the rod F, by means of a slot s, in the rod, and a tenon i, on the back of the valve; the slot being longer than the tenon, to allow a considerable degree of lost motion of the rod with respect to the valve. The connection may be made by any other means that will allow of the lost motion, the object of which is, that while both valves are operated by the same rod F, the secondary valve H, may always have the lead of the main valve. The valve rod F, is connected outside of the cylinder E, by a connecting rod, with a short crank K, which is loose on a fixed stud L, secured in a rigid arm M, attached to the main cylinder, or in any other fixed support. This crank serves to limit the movement of the valves, and also to effect the first part of the movement thereof, in either direction, as will be presently described. The stud L, has also fitted loosely to it a lever N, on which there is formed a fork j, j^1, embracing a crank K, but made so much wider as to permit the crank to make a quarter of a revolution of the crank within the said fork. The lever N, is fitted into a sleeve P, which is pivoted by a pin k, to an arm Q, that is rigidly secured to the main piston rod C.

The operation of the valves is as follows:—The first part of the movement of both of them is effected by the action of the arm Q, of the main piston rod on the lever N, the prongs of the fork j, j^1, of the said lever operating alternately on the opposite sides of the crank K, to bring the said crank from a horizontal position on either side of the stud L, to the

vertical position shown in fig. 1; and the movement of the valves is completed by the action of the valve rod, produced by the admission of steam by the secondary valve H, to act upon the piston I, or I^1; the crank K, being by that means brought from the vertical position to the horizontal position opposite to that from which it started.

To illustrate the operation clearly, suppose the main piston B, to be completing its stroke to the left, as represented in fig. 1:—In doing this the arm Q, has moved the lever N, to such a position that the prong *j*, of its fork has brought the crank K, from a horizontal position on the left side of the fixed stud L, to a vertical position above the said stud, as shown, and the crank has moved the valve rod pistons I, I^1, and valves to the right, far enough for the secondary valve H, to have commenced opening its port *d*, to the steam in the chest D, and its port d^1, to the exhaust port *e*, but not far enough for the main valve G, to have opened the port *b*, to the steam, and the port b^1, to the exhaust. This condition is represented in fig. 2; the steam—entering by the port *d*, and passage *h*, to the cylinder E, while the port d^1, and passage h^1, are open to the exhaust—acts very quickly on the piston I, and causes the valve rod, the valve, and the other piston I^1, to move quickly to the right, far enough to give the port *b*, a wide opening to the steam, and b^1, a wide opening to the exhaust pipe. This movement is limited by the crank K, arriving in a horizontal position on the right side of the fixed stud L. The main piston then commences moving to the right, and, as it completes that movement, causes the projection j^1, on the lever N, to bring the crank again to the upright position represented in fig. 1, and so moves the valves H, and G, to such a position that the opening of the port d^1, to the steam, and *d*, to the exhaust, has commenced when steam enters by the passage h^1, into the cylinder E^1, and acts upon the piston I^1, thereby causing the further movement of both valves in a sudden manner to the left as far as permitted by the crank K; thus completing the opening of the port d^1, to the steam, and *d*, to the exhaust, and effecting the opening of the main port b^1, to the steam and *b*, to the exhaust, and so causing the movement of the main piston to the left to take place. In completing its movement to the left, the arm Q, acts upon the lever N, and causes the prong *j*, of the said lever to bring the crank to the upright position represented in fig. 1. The continual operation is but a repetition of that described. Instead of the lever N, and crank K, being both loose on a fixed stud, as described, either may be secured to a rock shaft upon which the other is fitted loosely.

The patentee claims, "the arrangement of the secondary and main valves side by side in the same chest, and in direct connection with the same operating rod; the said rod having attached to it the pistons for completing the movement of the main valve, and having a lost motion with respect to the main valve, but none with respect to the secondary valve, all substantially as herein described; also the crank K, and forked lever N, applied substantially as described in combination with each other, and with the valve rod and main piston rod, for the purposes set forth."

To THOMAS HACK, *of the West Middlesex Waterworks, Hammersmith, and* ALFRED EDWIN CARTER, *of the West Middlesex Waterworks, Kensington, for improvements in screw cocks.*—[Dated 6th March, 1862.]

IN constructing screw cocks, such as are employed on water and gas mains, it is usual to employ a metal valve, which is made truly flat on the face, and rests against a corresponding face, through which the passage for the fluid is formed. The valve is capable of being worked up or down, so as to slide it on the face by means of a screw spindle, and thus the valve may either be set so as to cover and close, or uncover and leave open, the passage for the fluid, as may be required. The screw spindle usually passes out through the cover of the valve case; and the hole by which it passes is packed around the spindle with fibrous material, to prevent the escape of fluid. This packing wears rapidly, and requires to be frequently replaced. To avoid the use of such packing, the patentees adopt the arrangement shown in section in Plate X.

a, is the valve, made truly flat around the edges of its two opposite sides. These flat portions are received in a groove or recess, formed around the passage through which the fluid is to pass, as is usual; *b*, is the screw for raising and lowering the valve: its lower end is received in a hole in the bottom of the chamber, into which the valve is received when raised, and at its upper end it is suitably formed to receive the key *c*, the cylindrical portion c^1, of the stem of which passes through a corresponding hole in the cover *d*; the enlargement at the lower part of the key is also cylindrical, and fits within a chamber formed in the cover *d*, to receive it. *e*, is the ring placed between the top of the chamber in the cover and the top of the enlargement on the key: it is fitted to the surfaces, both above and below it. This ring is, by preference, made of brass, but it may be of other metal or material. Water is admitted to the hollow of the key *c*, through the passage b^1, formed through the screw spindle *b*; the enlarged part of the key *c*, is thus forced upwards against the ring *e*, so forming a fluid-tight joint, and preventing fluid escaping by the hole or passage in the cover *d*, through which the key passes. *f*, is the guide ring, for steadying the upper end of the screw spindle *b*. This ring is screwed into the bottom of the chamber formed in the cover, but it may be attached to the bottom of the cover, by the ring having lugs formed upon it, which are connected to the cover by screws, or it may be otherwise connected to the cover. A collar b^2, on the screw stem, also comes against the bottom of the ring *f*, so that the screw is also by it prevented from rising. On the upper surface of the ring *f*, is supported a spring *g*, which presses the key *c*, upwards against the ring *e*, and thus ensures a fluid-tight joint being obtained. *h*, is a cover fitted to the square head of the key *c*, and capable of revolving with it. This cover is to exclude any foreign matter from getting between the cylindrical portion c^1, of the key and the hole in the cover through which it passes.

To SIR CHARLES TILSTON BRIGHT, *of Victoria-street, for improvements in electric telegraphs, and in apparatus connected therewith, and employed in the manufacture thereof.*—[Dated 27th February, 1862.]

THE first part of this invention, which has reference to the receiving

apparatus or relay, consists in employing conducting fluids in a state of motion, into which the movable part of the relay is inserted or removed, in order to make or break local or secondary circuits, so that the conducting surface with which contact is made or broken, is constantly changed; and for this purpose, a fine stream or fountain of mercury, or acid and water, is preferred.

In Plate IX., fig. 1, is shown a relay, with a reservoir for holding the mercury or conducting fluid, in which A, A¹, are a pair of coils of fine wire; *b*, is the axle of a magnetic needle, contained within, and actuated by, the coils; the axle *b*, has fixed to it an arm *c*, which is stopped on each side by two adjusting screws in the usual manner, one of which is shown at *d*. The ends of the coils are led to terminals *e*, *e*¹, which are connected to the line wire and to the earth. The reservoirs F, F¹, are fixed to a tube *g*, *g*, fitting closely round the arm or bracket *h*. The necks of the reservoirs are hollow, and their orifices *i*, *i*, are opposite to two passages in the arm *h*, (shown by dotted lines) when the reservoirs are in a vertical position; *k*, is a pipe fixed to the arm *h*, communicating by the dotted passage with the upper reservoir, through which the stream of mercury or conducting fluid flows to a receiver *l*, and thence through the lower passage, marked also by dotted lines, to the lower reservoir. When the upper reservoir is empty, the position of the two reservoirs may be changed by the crank handle *m*, which carries a pinion *n*, gearing into a wheel *o*, which is fixed to the end of the tube *g*, *g*. The standard P, which supports the bracket *h*, *h*, and the reservoirs F, F¹, is connected to the terminal *q*. The upright R, which supports the coils A, A¹, and carries the axle *b*, of the magnet within the coil, is connected to the terminal *s*. The local or secondary circuit, being connected to the terminals *q*, *s*, on a current being sent through the coils A, A¹, the arm *c*, comes in contact with the fine conducting stream flowing from the pipe *k*, to the receiver *l*, and thus completes the local circuit.

By this means, perfect contact may be made with the most delicate horizontal needle, and the power required to work long circuits is much reduced. Signals may be recorded by the arm resting in the stream of fluid, or by passing through it. If signals are required on each side of the relay, the arm may terminate in a fork, and may be suspended, together with a magnetic needle, by a fine thread of silk, the axle being prolonged below, and dipping in a cup of mercury, so as to be in connection, through the upright R, with the terminals *s*.

A series of streams or fountains of conducting fluid is also employed; the motion of the moveable part or parts of the receiving apparatus among them causing various degrees of motion of such moveable part or parts to be marked upon any suitable recording apparatus included in the local circuit, by which various deflections, and the time in which such deflections rise and fall, may be recorded on paper.

The patentee claims, under the first part of his invention, "First,—the employment in receiving or relay apparatuses of conducting fluids in a state of motion, into which the moveable part of the relay is inserted or removed, in order to make or break local or secondary circuits, substantially in manner and for the purpose described; and, Second,—the construction of the particular relay apparatus represented at fig. 1."

The second part of the invention, which has reference to registering or recording the effects of electrical currents, consists in employing a band of

paper, drawn on by a train of clockwork or any other convenient motive power; a coloring fluid, in a state of motion, is caused to impinge upon the paper, and mark a line, or a series of lines, thereon; the line, or series of lines, is broken from time to time, through the colouring fluid being intercepted by an arm or arms moved by the electric currents; and thus the duration of the currents, or their variation of force, may be directly recorded upon paper: for registering the effects of earth currents, the clockwork train, carefully regulated as regards its speed of motion, is employed, so that the time of any deflection may be noted upon the paper.

The claim is for registering or recording the effects of electrical currents in manner described.

The third part of the invention has reference to the sending apparatus, whereby currents are communicated to the conducting wire. In passing currents into long lines of submarine or subterranean telegraph wire, the speed of signalling in the usual manner is retarded, and the distinctness of the several signals, one from the other, is impaired by the effects of induction, so that, for instance, a short signal (or dash) is liable to be merged into the long signal at the distant end, unless the sending key is operated so slowly as to allow a sufficient pause between the signals for the line to become clear of the residual effects of the preceding signals, before the following current is sent.

The present improvement consists of a key, which is operated in the same manner as the lever keys generally used, but which regulates the duration or the force of the currents sent into the line.

Fig. 2 represents the key, as adapted for regulating the ordinary single current alphabet of dots and dashes. *a*, *a*, is a lever key, working upon an axle *b*, and operated by the pressure of the finger upon the ivory button *c*. The key and the base *d*, *d*, upon which it is fixed, are connected with the terminal *e*, by the metallic strap *f*; and the terminal *e*, is connected to the line wire, when the instrument is in use. The stud *g*, which stops the motion of the key, is connected to the terminal *h*, which is connected to one pole of the battery; the other pole of the battery is connected to earth, so that a current flows into the line when the key is depressed. At the short end of the key is the screw *i*, the lower end of which presses against a small arm or lever *k*, and thus prevents it from coming in contact with the screw *l*, against which it would otherwise be pressed by the spring *m*. A click *n*, attached to the arm *k*, takes hold of the rough surface of the wheel *o*, upon the axle of which is fixed a spur wheel *p*, which gears into a train of wheels, terminating in the fan *q*. When the key is depressed, the click takes hold of the wheel *o*, and the speed at which the arm *k*, rises, is regulated by the adjustment of the fan *q*. The screw *l*, is connected to the terminal *r*, which is connected to the other pole of the battery, or to some intermediate point in the battery, so that, if the key is depressed for a longer time—say, for sending a stroke—than the time at which the arm *k*, arrives against the terminal *r*, the battery is placed upon short circuit, and no current flows along the line (or a part of the battery only may be cut off), if the connection with the terminal *r*, is made at an intermediate point. By this means, a longer interval takes place after a long signal than after a short one, although the operator is manipulating the key, with the usual pauses, irrespective of the currents actually sent into the line; and when once the rate of motion of the arm

has been properly adjusted to the requirements of the line operated upon, the signals will come out at the other end with equal spaces between them. A second arm, controlled by a fan, to regulate the time of commencement of the currents, after spaces of greater length than the spaces between the separate signals, may be used on circuits of very great length.

This system of adapting the duration or force of the current to the requirements of the line, may be readily applied to the keys now employed to send currents after the ordinary single current dot and stroke system, or to the method in use, to some extent, of sending two currents of opposite names for each signal recorded; but the positive and negative currents may be separately utilized by placing upon the axle of the key a wheel formed of two plates of metal, insulated from each other, and connected to the two poles of the battery; the direction of the current being changed at each upward motion of the key, by means of a ratchet wheel fixed to the commutator, and worked by a click upon the key.

The patentee claims, "the method of, and apparatus for, adapting the duration or force of the electric currents to the requirements of the line, described with reference to fig. 2."

The fourth part of the invention consists in applying protecting or preservative substances, in a warm or plastic state, to the outside of submarine and other electric telegraph cables, or conducting wires, by means of a wheel, roller, or circular brush, one part whereof runs in the substance employed to coat the outside of the cable or wire, while the cable or wire runs upon the upper side, and is coated without passing through the substance, whereby all danger of the insulating material being injured by heat (in case of the machinery requiring to be stopped), is avoided; or the cable or wire may be passed between two brushes or rollers.

The claim is for "coating the outside of electric telegraph cables and conducting wires, in manner described under this fourth part of the invention."

The fifth part of the invention consists in passing submarine and other cables or wires, after the application of any protecting or preservative substance, between rollers having grooved surfaces, adapted to the size of the cable, so that the preservative substance or compound, and any yarn, canvas, gutta-percha, or india-rubber strips, or tape, which may be used together with it, either warm or in a cold state, are compressed together into a solid mass, filling up all inequalities or interstices in the outside of the cable, and making the exterior coating smooth and regular throughout its length. The rollers are provided with adjustable springs, whereby any required degree of pressure may be given.

The claim under this head is "compressing an outer protecting material into the spaces between and upon such wires, in the manner described, whereby a hard coating is laid over the cable."

The sixth part of the invention has reference to cases where, from the surface of the cable to be covered being very irregular—as in the case of a large cable covered with strands of wire—or when, from other reasons, it is desirable to pass a cable directly through any protecting substance in a heated state.

The patentee claims, "raising it out of the substance, upon the stoppage of the machinery, by a sheave at the end of a lever being lifted

through the conveyance of a pair of heavy governor balls, whereby any danger of the cable being heated by the machinery stopping, is avoided."

The seventh part of the invention consists in, and a claim is made for, "covering submarine and other telegraphic cables or wires with such cements, mortars, or limes, as set and become solid under the influence of water; and also surrounding such substances, when necessary, with a serving of yarn, canvas, gutta-percha, or caoutchouc strips, or other material, to retain the substance upon the cables or wires during and after the process of manufacture, with or without any saturation of bituminous or other preservative compounds."

The eighth part of the invention consists in coating conducting wire with a covering or coverings of gutta-percha, and surrounding this with a covering or coverings of caoutchouc: the whole is coated with gutta-percha.

The claim is for "placing gutta-percha next to the wire, and covering it, first with caoutchouc, and then with gutta-percha, as described, whereby the injurious effects which commonly take place when the caoutchouc is next the metal are avoided, and the caoutchouc is protected by the outer covering of gutta-percha."

To ALEXANDER SAMUELSON, *of Cornhill, for improvements in building ships and vessels.*—[Dated 12th February, 1862.]

THIS invention is particularly applicable for building ships and vessels intended to receive armour plates, but ships and vessels which are not required to have armour plates fixed to them may also advantageously be constructed according to this invention.

In Plate IX., fig. 1 shows a horizontal section of a portion of a ship's or vessel's side coated with armour plating, wherein the upright ribs or frames of the ship or vessel consist of a series of acute angles, formed by rivetting plates to each other and to angle iron, and which are to be arranged at any desired distance apart, the outer plating or skin forming the base line of such angular ribs or frames. Fig. 2 shows another horizontal section of a portion of the side of a ship or vessel, also plated over with armour plating, in which figure the upright ribs or frames are rectangular; the sectional angular form of the ribs or upright frames may be varied; b^1, b^2, are the upright ribs or frames, which are each constructed of sheets of metal rivetted to each other, and, where necessary, to angle irons; or, if preferred, the sheets may be bent at their edges, so as to form flanges, in place of using angle iron at the angles where the sheets are rivetted to each other, or to the plating of which the skin of the ship or vessel is composed. In figs. 1 and 2, angle iron is used at the angles where the plates are rivetted to each other, whilst in figs. 3 and 4, which are similar sections to those shown in figs. 1 and 2, the sheets of which the ribs or upright frames are constructed, are formed with bent edges, to produce flanges suitable for fixing the parts of the ribs or upright frames together by rivetting. The plates which are to form the armour plating of a ship or vessel are each turned up at their ends, so as to form internal flanges; and where the ribs or upright frames are formed to an acute angle in section, the metal of the interior flanges of the armour plates is bevilled; so that when the flanges at the ends of two contiguous

armour plates come together, within a rib or upright frame, they will fill the interior of such rib or upright frame, and the plates of such rib, as well as the flanges of the armour plates, may then be securely fixed by through-bolts, which it is preferred should be screw bolts with nuts. By these means, the armour plates will contribute great additional strength to the construction of the body of a ship, in consequence of the flanges at the ends of the armour plates entering the hollow ribs or upright framings of the ship or vessel, and by reason of their being fastened thereto and to each other; whilst the use of bolts through the armour plates is rendered unnecessary. The outer skin of armour-plated vessels may be made by plating, according to any of the systems of plating heretofore practised, but it is preferred that the edges of the sheets of the outer plating or skin should not lap where they are rivetted together, but that their edges should butt together, and be rivetted to butt pieces, as is well understood: this, however, is not essential. In figs. 1 and 2, *a*, *a*, is the plating, forming the outer skin of the vessel; this skin or outer plating is shown to intervene between the back of the armour plating and the angular ribs or frames. This, however, is not essential, as the ribs or upright frames may, when desired, come directly against the back of the armour plating; in which case the skin or outer plating would be used between the ribs or upright frames; or where the ribs or upright frames are triangular in their horizontal section, they may come close together, forming a uniform zig-zag framing, constructed of plates and angle iron rivetted together. *b*, *b*, are the angular hollow ribs or upright frames, which are produced by rivetting plates to each other, and to angle iron *c*, *c*, and *d*, *d*, where desired. In figs. 3 and 4, the angle irons *d*, *d*, are dispensed with, and the plates of which the ribs or upright frames are composed are bent at their edges, to form flanges where necessary. The forms of angular hollow upright ribs or frames are those which are preferred, but their forms or sections may be varied: when desired, inner plating or ceiling of metal or wood may be used, and rivetted or otherwise fastened to the upright hollow ribs or frames; wood backing to the armour plating may also, as heretofore, be applied, if desired.

The patentee claims, "the construction of angular ribs or upright frames of plates, rivetted to each other and to angle iron, to which ribs or upright frames the outer plating or skin is fixed by rivetting, and to which ribs or upright frames armour plating, when used, is also fixed, by internal flanges, as described."

To John Imray, *of Westminster-bridge-road, for improvements in hinges.* —[Dated 25th February, 1862.]

This invention relates, in the first place, to a mode of constructing cast-iron hinges of the kind commonly known as Collinge's or spherical hinges. The joint of such a hinge ordinarily consists of a wrought-iron or steel ball-ended pivot, which is fixed tightly in the knuckle,—the ball end of the pivot being made true and smooth, so as to turn freely in a cup which forms the step of the hinge; but instead of making the pivot a separate piece from the knuckle, and fixing it therein, the pivot is chill-cast in one piece with the knuckle, and is afterwards rendered smooth by scouring it with emery or other suitable polishing material.

The improvements apply, in the second place, to the construction of spring hinges, and the shoes, centres, or hangings used in connection therewith.

In Plate IX., fig. 1 is a section of the spring hinge, and fig. 2 is a plan of the same, with its cover removed, to show internal parts. *a*, is the case of the hinge, having a cover a^1, fixed on it by screws, the whole being let into the floor immediately beneath the heel of the door, so that the upper surface of the cover a^1, is level with the floor. *b*, is a cylindrical box, containing a volute spring, like that of a clock or watch: the upper edge of the box *b*, is recessed to receive a cover b^1, made in one piece with a spindle, which projects upwards into a round hole in a bracket *d*, (to be described hereafter) and downwards through a round hole in the bottom of the box *b*, into a cup formed in the case *a*; the spindle and cover b^1, being thus centered above and below in the bracket *d*, and in the case *a*, and the spring box *b*, being also centered on the edge of the cover b^1, and on the lower part of its spindle, so that either the cover and spindle b^1, or the box *b*, can turn freely on their common vertical axis. One part of the box *b*, is thickened to receive a screwed pin *c*, which projects inwards, with an end notched to catch into a hole in the outer end of the volute spring; and another screw pin c^1, is fixed in the spindle b^1, having its projecting end notched in the same way to catch into a hole in the inner end of the spring in the usual manner. *d*, is a bracket fitted into slots in the case *a*, and held down in its place by the cover a^1. *e*, is a radius, one end of which is fitted into a fork formed in the bracket *d*, and has a round hole fitting the spindle b^1, so that the radius *e*, can turn freely thereon; the other end of the radius *e*, carries a roller e^1, mounted thereon, so as to turn freely on a vertical axis. *f*, is a lever, pivotted below in a cup formed in the bracket *d*, and above in a round hole in the cover a^1, its axis projecting above the cover, with its upper part squared; the arm of the lever *f*, is slotted along its under side to admit the roller e^1, which projects up into a slot, and can roll along it. b^2, is a stud, projecting upwards from the outer edge of the spring box *b*; and b^3, is a pin, projecting upwards from the cover b^1, and fitting a notch in the side of the radius *e*, and a similar notch in the bracket *d*; these notches being so adjusted in depth, that when the radius *e*, is in its middle position, lying immediately over the bracket *d*, the stud b^2, and the pin b^3, bear against the opposite sides of both the bracket and the radius. The squared top of the axis of the lever *f*, is fitted to a shoe (to be described hereafter) attached to the heel of the door, so that when the door is turned in either direction, the lever *f*, is turned with it, and causes the radius *e*, to turn. This radius, when turned in the one direction, bears against the pin b^3, and thereby turns the spindle b^1; the box *b*, being prevented from turning in the same direction by its stud b^2, bearing against the side of the bracket *d*. The spring being thus wound up, on the door being left at liberty, the elasticity of the spring pressing the pin b^3, against the radius *e*, turns it, and with it the lever *f*, and the door, till they attain their middle position, where the pin b^3, is stopped by the bracket *d*, and the radius *e*, is then held by the force of the spring between the pin b^3, and the stud b^2, and retains the lever *f*, and the door in its closed position. When the door is moved in the opposite direction, the radius *e*, leaving the pin b^3, to bear against the bracket *d*, carries round the stud b^2, and the spring box *b*, and thereby winds up the spring, which, on the door being

left at liberty, causes it to return to its middle or closed position. The lever *f*, and the radius *e*, are mounted on axes, which are excentric to each other, so that, in turning them, the roller e^1, runs along the slot in the lever *f*, and thus varies the leverage with which the spring acts thereon, so as in some measure to compensate for the variation in the force of the spring as it is more or less wound by the motion of the radius *e*. The shoe for the heel of the door and the top centre is constructed in such a manner that the door can be readily removed or replaced. The shoe *g*, is screwed to the lower edge of the door, and is notched or forked at the back to fit the squared top of the lever *f*. *h*, is a covering piece, shaped to suit the back edge of the door fitted to the notch in the shoe *g*, and secured to it by a screw h^1. The top centre, a section of which is represented in fig. 3, consists of a plate *k*, screwed to the framing above the door, having fixed in it a round-ended pivot k^1, which projects downwards into a shoe *l*, screwed to the top edge of the door; this shoe *l*, is notched at the back and formed with a cylindrical recess, which contains a cup l^1, fitted to the pivot k^1. When the cup l^1, rests at the bottom of the recess, its upper lip is below the point of the pivot k^1, which is thus left free to pass through the notch at the back of the shoe *l*; but the cup l^1, being formed with an incline at its bottom, a covering piece *m*, having an inclined projection, which fits the bottom of the cup, is pushed into the slot and raises the cup l^1, till it embraces the pivot k^1; the covering piece *m*, being retained in its place by a screw m^1. When it is desired to remove the door from its hangings, the covering piece *h*, is removed from the bottom shoe, and the covering piece *m*, from the top shoe,—permitting the cup l^1, to drop down clear of the pivot k^1, so that the door can be drawn away horizontally; and it may be replaced, and the covering pieces secured when desired, as may be readily understood.

The patentee claims, "First,—the mode of constructing the pivot of the cast-iron hinge, commonly known as Collinge's, or the spherical hinge, by chill-casting it in one piece with the knuckle. Secondly,—the general construction of the spring hinge herein described. Thirdly,—the general construction of the shoes and top centres or hangings of doors, as herein described, whether these hangings be used in connection with the spring hinge herein described or with other hinges."

To JOHN GJERS, *of Middlesborough, Yorkshire, for a material or sand for the formation of moulds for casting iron, and for other like purposes.*—[Dated 4th March, 1862.]

IN making pig iron, as at present commonly practised, the melted metal is run from the blast furnace into moulds formed of natural sand. Instead of this natural sand, the patentee employs, in making for such and similar purposes, an artificially-prepared material or sand, or a mixture of such artificially-prepared material or sand with natural sand.

The artificial material or sand consists of slag from blast, puddling, ball, mill, or other furnaces, brought to a suitably minute state of division by crushing it, when cold, in suitable mills, or by any other convenient means; but the method preferred is, to run the slag, in a melted state, in a small stream, into a quantity of water, wherein its sudden cool-

ing causes it to become divided into small particles, somewhat resembling natural sand, as required.

The particles obtained by this process of running the slag into water, are deprived of such sulphur as may happen to be in the slag, and are so porous in character, as to be capable of being still further easily reduced by being passed between rollers, or by any other suitable mechanical means.

As a material for forming "pig beds," or moulds for the casting of iron in the form of pigs or otherwise, this artificial sand is, for several reasons, superior to ordinary natural silicious sand, as commonly used. The pigs come out cleaner, and show what is technically termed "kish" on the outside; and the silicious coating left by ordinary sand, and which requires a certain amount of limestone to flux it in the cupola, being avoided, and a smaller amount of slag, which is in itself a flux, substituted, sufficient limestone to flux the ashes of the fuel only is required in the cupola. And further, in the process of puddling, this artificial sand avoids the waste of iron due to the presence of the greater amount of silica existing in pigs run in ordinary sand; while, at the same time, the lime and alumina are to the extent of the quantity contained in the artificial sand that adheres to the pigs, favourable to the removal of the sulphur and phosphorus contained in the pig iron.

The artificial sand, reduced to any required degree of fineness, may be employed, either alone or mixed with natural sand, in the formation of moulds for casting any required forms or objects, either in iron or other metal.

The patentee claims, "the employment of furnace slag, reduced to the required state of fineness or division, either alone or mixed with natural sand, in the formation of moulds for casting iron or other metals."

To THOMAS HENTON WOOD, *of Blackweir, Glamorganshire, for improvements in apparatus employed in the manufacture of artificial fuel.*—[Dated 7th March, 1862.]

THIS invention consists in constructing and arranging a cylinder, and parts connected therewith, in which cylinder dry and hot coal and pitch are finally intimately mixed together during their manufacture into artificial fuel, in such manner that the cylinder may be maintained from top to bottom at a red heat, and that the material may be passed through the cylinder, and be thoroughly mixed and amalgamated therein, without choking or clogging.

Within an outer casing lined with fire-clay or other material, to prevent loss of heat by radiation, is placed a vertical iron cylinder or tube, a space being left between the casing and the tube. This space is made into a spiral flue, communicating at bottom with a furnace, and having its outlet near the top and from the sides of the apparatus. Upon a shaft made to rotate inside the cylinder, arms are fixed, the ends of which are turned or bent up or down at a right angle. These bent ends act as scrapers, to keep the cylinder clean and prevent it being clogged.

The figure in Plate X. is a longitudinal section of the apparatus. *a*, is a vertical cylinder, and *b*, is the outer casing, made to form a spiral flue, by which heat is conveyed round the cylinder *a*, from a furnace A, open-

ing into the said flue; *c*, is a shaft passing through the cylinder, and supported at bottom in a shoe *d*; *e*, is a socket joint or coupling, to allow of the shaft being removed when not in use, or of its being replaced by another, should circumstances require it; *f*, *f*, are arms on the shaft, with bent-up ends f^1, f^1, and turn-down ends f^2, f^2. The dry and hot coal and pitch are fed in at the top of the apparatus, and escape from the lower part thereof through the outlet *g*. *h*, is a flap or shoot, the outer end of which is connected by a chain or rod *i*, to a lever *k*, with a balance weight, so that the opening *g*, can be closed when the machine is first put into operation, and afterwards either partially or entirely opened, as the state of the material operated upon may require; thus regulating the angle at which the flap is kept, and thereby the discharge of the amalgamated material. *l*, *l*, is the driving gear.

The patentee claims, "the employment in apparatus for the manufacture of artificial fuel, of a cylinder or tube, in which dry and hot coal and pitch are mixed and amalgamated; which cylinder or tube is maintained from top to bottom at a red heat, substantially in manner hereinbefore described."

To JOHN AVERY, *of Mark-lane, for improvements in purifying coal,—being a communication.*—[Dated 15th March, 1862.]

THIS invention consists in subjecting coal to the action and heat of free steam, in a suitably enclosed chamber, and also to the chemical action of common salt, potash, quicklime, and sal-ammoniac, for the object of purifying the same. The coal, as it is got from a mine, is introduced into a chamber capable of being pervaded by steam, at a pressure of about 10 or 12 lbs. on the square inch in the boiler. The steam is conducted from the boiler into the chamber by a suitable steam pipe, so as to keep up a constant atmosphere of steam in the chamber and in the interstices amongst the coal therein. When the coal has become well heated, the common salt, potash, and quicklime are progressively applied. This may be conveniently done by applying to the steam pipe which supplies the chamber with steam from the boiler, a vessel, which is connected by a pipe and stop-cock, in such manner that the chemical matters used may descend from the vessel gradually into the steam pipe, and be conducted by the steam into the chamber containing the coals. The chamber having been supplied with a charge of coals, the steam is to be admitted into the chamber, and a continued atmosphere of steam is to be kept up therein till the coals have become thoroughly heated. Then the chemical matters above mentioned are to be applied from the vessel containing them. As the quantity of sulphur contained in coals is found greatly to vary, no precise rule can be given as to the quantity of the chemical matters to be used, nor of the time occupied in applying steam to the coals placed in the chamber: a workman will, however, quickly gain experience, and will readily judge the effect of the process on the qualities of coals he may be called on from time to time to purify. The quantities and proportions of the chemical matters which have been commonly employed are as follows:—For 30 tons of good coals, not largely impregnated with sulphur, 30 lbs. of common salt, 2 lbs. of potash, and 2 lbs. of quicklime.

These matters are intimately mixed, and placed in the vessel which is, as above stated, applied to the steam pipe which connects the chamber with a steam boiler, and such materials are allowed gradually to fall from the vessel into the steam pipe, and they are carried into the chamber by the passing steam, which is caused to flow continuously from the boiler into the chamber; provision being made for steam to flow out of the chamber, so as to require a continuous supply. The chemical matters above mentioned having been carried into the chamber and amongst the coals therein, the steam is to be continued to be supplied for some time, say, for one hour. The sal-ammoniac (2 lbs. for the quantity of coals above mentioned) is then to be placed in the vessel, and the same is to be allowed to flow into the steam pipe, and to be carried by the steam into the chamber; and after the sal-ammoniac has been introduced, the steam heating of the coals in the chamber is to be continued again for a time, say for an hour, when the process will be complete, and the chamber may be discharged of its contents and then re-charged. When coals containing a considerable quantity of sulphur are to be purified, then larger quantities of the chemical matters are to be used, and the process continued for a greater length of time.

The patentee claims, "subjecting coals to the process described."

To Henry Young Darracott Scott, *of Brompton Barracks, near Chatham, for improvements in the manufacture of cement.*—[Dated 15th March, 1862.]

The object of this invention is to manufacture the patent cement, known in the market as "Scott's cement," in a more certain and economical manner than heretofore. To attain this end, the patentee submits quicklime, in a powdered state (or the lime may be partially slaked, and still answer the purpose), to the action of sulphurous acid gas, in the presence of some efficient oxydizing agent, and thus ensure a rapid and thorough conversion of the lime into cement.

The pulverized lime is sifted, by the aid of a revolving drum, made with meshes, or equivalent means, through a flue or shaft built of, or lined with, fire bricks, and kept at a full red heat by the flame of an adjacent reverberatory furnace, which is caused to play into the shaft, and down which passes a continuous stream of sulphurous acid gas. The flame and sulphurous acid gas are made to turn down the shaft by the draft of a chimney stack, which gradually splays outwards towards the top, so as to moderate the draft, which it is necessary to keep up over the fire bridge, before the heated air finally escapes into the atmosphere. By thus moderating the draft, the finer particles of cement that pass onward with the ascending gases, are not carried out of the chimney, but deposited on its sides, and fall back.

The flame, in passing down the shaft, heats the powdered lime in its fall sufficiently to enable the lime to absorb the sulphurous acid gas which passes down with it.

For the production of the sulphurous acid gas, a large iron vessel of sulphur is provided, and, by means of a small fire underneath the vessel, the sulphur is caused to burn with sufficient rapidity to give off a large

volume of gas. The patentee employs 1 lb. of sulphur, more or less, for every 80 lbs. of lime; and sometimes substitutes for sulphur, in whole or in part, iron pyrites, Brassy coal, and other substances, which can be made readily and economically to give up the sulphur they may contain.

The sulphurous acid gas generated by the burning sulphur, is conducted into the reverberatory furnace before mentioned, through the floor of the ash pit of that furnace; a louvre board arrangement of ash-pit floor being adopted, to permit of the gaseous product passing through, while the cinders which fall from the bars of the furnace are retained on the floor. When the gas has entered the ash pit, it makes its way into the fire-place, between the fire bars, and thoroughly intermingles with the furnace flames. If iron pyrites, or other like substances, be used, however, for the production of the sulphurous acid, they may be mingled with the fuel of the furnace: in that case, the peculiar ash-pit arrangement above described will be unnecessary.

In order to give the sulphurous acid gas a better opportunity of acting upon the lime, feather-edged fire tiles are placed across the shaft, having their broad surfaces at a steep inclination—about 70°. The operation of these surfaces will be to delay the descent of the lime, and thereby increase its temperature.

The lime powder, as it makes its way through the shaft, takes up a small per centage of the sulphurous acid, and, under the influence of the high temperature and atmospheric air which should be present, rapidly passes to that condition which is necessary to the production of the cement.

If the fire be properly managed—the fresh fuel being always added in a manner to coke it when at a distance from the fire bridge, and the area over the fire bridge being proportioned to the combustion—additional air will be required to perfect the consumption of the smoke, and to supply the oxidizing agency requisite for the re-conversion of any sulphurous acid which may have been decomposed, and to complete the process. This can be supplied by perforations through the wrought-iron casing, which should enclose the sieve already referred to.

The cement, as it falls to the bottom of the shaft, may be removed by an endless chain of iron buckets, working over tension pulleys, or by other suitable machinery; and, when removed, it should be spread out to cool; or its cooling may be hastened by suitable mechanical arrangements.

Successful results may be obtained by the use of shafts from one foot square in plan to four feet by two feet and upwards, with a drop for the lime of from four to ten feet, so long as the furnace attached to it is of sufficient size to make the lime red hot, and the draft is properly regulated. Four feet by two feet, with a vertical drop of eight feet, are good working dimensions for the shaft, the flame playing across the shorter dimension.

Other means than that described may also be employed for impregnating the powdered lime with the required substances. For instance, instead of making the lime powder red hot, the lime powder may be introduced into a cylinder, or other chamber, fitted with the means of constantly carrying it to its upper part, and allowing it to drop across the cylinder. While the cylinder is rotating, vapour of water and sulphurous acid are to be passed into it, and the compound resulting from this operation is to be exposed to the oxidizing influence derived either from nitrous acid fumes

and atmospheric air, or heat and atmospheric air. Or, again, instead of the above sulphurous acid gas, atmospheric air and vapour of water may be passed over spongy platinum or other oxidizing agent contained in a tube, into a cylinder, such as that above described.

The patentee claims, "subjecting lime, in the pulverized state, to the action of sulphurous acid gas and an oxidizing agency, in the manner and for the purpose above described."

To CONSTANTINE NICOLAUS KOTTULA, *of Belle-Isle, Middlesex, for improvements in the manufacture of combined soaps.*—[Dated 15th March, 1862.]

THIS invention consists in the combination of pearlash with combined soaps, whether with such combined soaps as result from the combination of a curd with a hydrated soap, according to the invention patented by James Blake and Francis Maxwell, dated 30th August, 1856, or with such combined soaps as result from the combination of a curd soap with elements producing a hydrated soap, no matter in what manner they may be manipulated, combined, and finished, or with such combined soaps as result from the combination of any ordinary finished soap with a hydrated soap, or with the elements producing a hydrated soap, mottled or not, and with or without resin. The proportion of pearlash varies, according to the excess of spent leys (salts) contained in the curd and ordinary soaps, also according to the quality of the leys used in the combination. Thus, one cwt. of pearlash to three tons of combined soap, and also three times the quantity of pearlash to that quantity of combined soap, have been found to answer well. The pearlash is used to effect the neutralization of spent leys (salts) contained in the soaps, as well as to effect the neutralization of leys used in the combination; consequently the proportions of pearlash vary, according to the evils remedied.

To WILLIAM DANIEL ALLEN, *of Sheffield, for improvements in the manufacture of stamp heads and beds employed in crushing ores and other mineral substances.*—[Dated 13th February, 1862.]

THIS invention consists in the manufacture of stamp heads and beds, by founding or casting them in molten steel, which, for this purpose, it is prefered to use in a hard or highly carbonized state, or to add to the molten steel as much cast or pig iron as will give the degree of hardness required. In carrying the invention into practical operation, the patentee employs iron moulds so formed as to impart the necessary shape and dimensions to the cast stamp head, due allowance being made for the shrinking of the metal; or, in lieu of casting them of the exact size required, they may be made a little larger, and rendered more dense by a small amount of hammering, which, at the same time, gives them the required dimensions.

The upper end of the stamp head may be so shaped in the mould as to suit the mode of fixing required, but when they are to be formed with the long slender shank in common use, this part should be made of hammered mild steel, or of wrought malleable iron, the shank-piece being of such

length as will admit of some five or six inches of it being immersed in the fluid steel at the time of founding. That part of the shank which enters the fluid metal is made of a dovetailed or such other form as will prevent it from being withdrawn from the stamp head when in use, and it may be further secured by boring a hole through the upper part of the stamp head, the hole passing also through the shank, into which a cross pin may be tightly driven. In inserting the shank-piece into the fluid steel, it may be made to occupy its proper position by attaching it to a moveable guide fitted to the mould, so that it may be quickly inserted into the fluid metal after the same has been run into the mould; or the shank may be first put into position, and the molten steel be poured in, and allowed to rise up and surround the heated portion of the shank. A "stopper" may, if necessary, be then put down upon the upper surface of the fluid steel, or the shank-piece may be made to project from the under side of a mould stopper, and thus determine both its position in the mould and the depth to which the heated end of the shank is immersed in the fluid metal.

The moveable beds on which the ores or other mineral substances are to be crushed may be made by founding them in molten steel of a highly carbonized quality, as hereinbefore described; the said beds being cast either of the exact size required, or of a size a little in excess of such dimensions, and then reduced by a small amount of hammering, in order to perfect their exterior surface, and render the metal more dense, as in the making of the stamp heads. If cast with a head of metal, it may be removed by a saw or other cutter while hot, or planed off when cold.

Scientific Notices.

INSTITUTION OF MECHANICAL ENGINEERS.

(*Continued from page* 243.)

"*Description of a feed-pipe connection for locomotive engines*," by Mr. Alexander Allan, of Perth.

Various constructions of feed-pipe connection between locomotive engines and tenders have been used at different times; but the double ball and socket plunger pipes, made of brass, are most generally applied, in order to have a continuous metallic connection allowing of blowing steam through into the tender without injury. These, however, are very expensive, requiring great nicety of fitting and much care in their management in work; and, in consequence of sand and dirt getting in at the moveable parts, they involve a serious outlay for maintenance; and in practice it is almost impossible to keep them perfectly tight, while if the joints be too tightly screwed up there is risk of the feed-pipes breaking.

To obviate these defects, and obtain a continuous metallic connection, comparatively inexpensive, both in first cost and maintenance, and combining simplicity, durability, and efficiency, the writer has substituted a connection, consisting of a simple brass or

copper tube, coiled to a circle of considerable diameter, so as to have sufficient elasticity to allow for the vertical disturbance due to the unequal deflection of the engine and tender springs, and also for the extreme lateral range required in going round the sharpest curves, with a minimum strain on the joints. A solid-drawn brass tube is employed, varying from No. 17 to No. 14 wire-gauge in thickness, or ·060 inch to ·085 inch, coiled to a circle of 3 feet to $3\frac{1}{2}$ feet diameter.

In order to offer less resistance to bending, the tubes are made elliptical in section, about $2\frac{1}{2}$ inches deep by $1\frac{1}{2}$ inch broad. Tubes of circular section, 2 inches in diameter, have also been used, but they are more rigid than the elliptical tubes. Experiments have been made to ascertain the amount of force necessary to stretch and compress the coiled tube, and also to deflect it vertically and laterally through the extreme range required in practice; and the results show that the elliptical tube has the advantage in elasticity,—the first inch of deflection requiring only about 30 lbs. pressure, while a total pressure of from 90 to 100 lbs. is sufficient to produce the extreme deflection of about 3 inches in any direction; up to this pressure there is no permanent set, and consequently no fear of the tube collapsing in any part. The experiments have been extended with the elliptical tube up to $3\frac{1}{2}$ inches movement in any direction, giving a total range of 7 inches, up to which the tube may be strained safely; beyond this limit a permanent set is produced. In practice, however, the total range in any direction never exceeds 5 inches, or $2\frac{1}{2}$ inches on each side of the central position,—leaving a sufficient margin of elasticity to prevent injury to the tube. With a thinner tube, or one coiled to a larger circle, an increased range could be obtained if desired

The connecting tube is attached to both engine and tender, by means of the ordinary screw and tail pipe couplings, the tail pipes being brazed upon the circular ends of the tube. It is placed above the axle, and suspended to the foot plate by short chains, so that the wheels can be removed without interfering with the feed-pipe connection, and it is less liable to damage, should the engine get off the rails, than the ordinary ball-and-socket couplings. The connecting tube is placed central in the engine, whenever practicable, so that the angular deflection produced in running round curves is reduced to the minimum; but it can be fixed, without any practical objection, in the usual side position of the feed-pipe, so as to admit of ready application to existing engines and tenders.

This connection has been fitted to a number of locomotives on the Scottish Central Railway, including some large goods engines; and it has been subjected to severe tests during the last twelve months, and has given every satisfaction. In the engines on this railway the plan of coupling between the engine and tender, drawing as well as buffing on a heavy laminated spring, allows more movement than is usual, amounting to a play of 2 inches between the engine and tender, and the connecting tube is 6 inches out of the centre; but even under these conditions no failure of the connecting tube has occurred. The dimensions of the engine to which it has been longest attached are—diameter of cylinder, 16 inches; stroke, 20 inches; driving wheel, 6 feet

diameter; steam pressure in boiler, 130 lbs. per square inch, and boiler supplied with one No. 9 injector; and the connecting tube has now been continuously working upon this engine for nearly twelve months, with complete success, the engine having run about 20,000 miles during the time. This tube was taken off the engine, and exhibited to the meeting: it was of circular section, and simply secured with soft solder, and no sign of its giving way was perceptible, thus proving that it is fully equal to its work. A specimen was also exhibited of a connecting tube of oval section, used on large coupled engines: in its manufacture, the tube is swaged oval in proper cresses, and is then filled with resin, and coiled to the required circle round the cast iron blocks used for blocking tyres.

Mr. Sampson Lloyd believed a somewhat similar plan of coupling had been tried on the South Western Railway, but did not know whether it had been successfully carried out on that line.

Mr. D. Joy thought the new coupling was the best connection he had seen, and much superior to either the ball-and-socket coupling, or the flexible hose pipes.

The Chairman inquired what was the cost and durability of the ordinary hose pipes.

Mr. D. Joy said the flexible hose pipes of canvas and india-rubber were the simplest connection, and cost only about 7*s.* 6*d.* each; but their durability was very uncertain; they lasted twelve months with proper care, if made of good material, but sometimes failed in a single month. He thought the coupling now shown seemed as good in simplicity, and was much superior in durability; and it had an advantage in being placed close up under the foot plate, where it would be out of the way of injury if the engine got off the rails.

Mr. J. Murphy suggested that an iron tube might be used, as cheaper than brass or copper.

Mr. D. Joy thought the extra cost of the brass or copper tube would be saved in the manufacture, from the greater ease of manipulation compared with iron, the total weight of metal being so small; an iron tube would also be more rigid, while the greater elasticity of brass or copper would increase the durability of the coupling.

BRITISH ASSOCIATION.

Selected Papers read at the Cambridge Meeting of the Society.

"*Rifled guns and projectiles for penetration*," by T. Aston, M.A., Barrister-at-Law.

As it is now an admitted fact, that naval warfare will be carried on by iron-clad navies, it has become an imperative necessity that the navy of England shall henceforth be armed with artillery adapted for attacking the new armour plate defences which all nations are hastening to adopt. The superiority which defence so suddenly acquired over attack, by simply putting on a coat of armour, threatened to upset not

only the theoretical but the practical tactics of modern warfare. The necessity of improving the means of attack, so as to restore as far as possible the disturbed equilibrium, was obvious to every one, and the contest which has been carried on in this country for the last two or three years between the attack of improved artillery and the defence of improved armour plates, has been watched by all of us with the greatest interest. From a scientific point of view, with which we are on this occasion more immediately concerned, the subject was one which engaged the attention of some of the keenest and most experienced intellects of the country; these, on the one hand, giving practical aid on the side of defence,—those, on the other, devoting their best energies to restore attack to what must be considered its normal position of superiority. For a long time—for too long a time—the defence people had much the best of it. Under the energetic superintendence of the Plate Committee (who in this matter *de republicâ bene meriti sunt*) armour plate targets were erected by our able engineers, which at fighting ranges laughed to scorn the utmost efforts of the artillery attack brought against them. Some of the targets combined the resistance of iron with wood, others, constructed with far-seeing ingenuity, depended upon iron alone. The Ordnance Select Committee were challenged to bring forward the best gun their artillery science, aided by all the resources of the royal arsenals and the public purse, was able to provide. The science brought to bear by the Ordnance Select Committee, after exhausting itself in repeated efforts to cover its repeated defeats—efforts that were fruitless for reasons that will be explained—was at length compelled to confess itself vanquished by the armour plates. But Ordnance had other resources which it hoped to have dispensed with, and upon which, in its disappointment, it was glad to fall back. It said to the Committee of Defence, "If you will obligingly set up your armour targets within a shortened range, say, for instance, a Robin Hood bowshot of 200 yards, you shall see what the brute force of the old smooth-bore will do. True it is, that cast iron will be brought to attack wrought iron, that a rounded missile will have to punch its way through a flat, and possibly, at times, inclined, armour plate—science, which proved but a broken reed in our hands, must be abandoned, but with a gun big enough, a shot heavy enough, a charge of powder large enough, and a range short enough, the smooth-bore shall smash your target." Of course it would, and so would a battering-ram, like those Titus used to smash the gates of Jerusalem. If, therefore, the old smooth-bore, with its short range, had failed the Ordnance Select Committee like the service rifled gun, they might have fallen back on the older battering-ram.

Looking at it from a scientific point of view, this retrogression was very humiliating, and it caused the country serious anxiety to hear her Majesty's Ministers state in Parliament, as they did in the last session, on the authority, of course, of their official scientific advisers, that the navy of England, after all the vast expenditure that had been lavished upon it, was at last obliged to be armed with the old smooth-bores, to meet the iron-clad navies of her possible enemies. It was, in fact, proclaiming England's weakness to other nations, who were more scientifically informed and better armed than she.

In further explanation of what was the actual condition in which

this all-important question stood no later than May last, I will quote the statement of an official authority upon the subject—Sir W. Armstrong. It was made by him at a meeting of the United Service Institution, May 20, 1862, in these words:—"It *certainly* may be said that shells are of no avail against iron-plated ships; but, on the other hand, I may say that neither 68-pounders nor 110-pounder guns, with solid round shot, are effective against such iron vessels. The fact is, what we want is a gun in addition to our 110-pounder rifled gun, especially adapted for breaking through iron plates. That is what we are in want of *now.*" This forced confession was very startling to all of us, who knew that, long ago, France armed her "Gloires" and "Normandies" with rifled 90-pounders, proved to be efficient against iron plates. Such, however, being the state of the question a few months ago, we may proceed to consider, first, the reason why the artillery hitherto employed in the service, including rifled guns and smooth-bores, has always failed to make any impression on the plated defences, at ordinary fighting range; and, secondly, by what means artillery science has lately reconquered its lost ground. Sir William Armstrong put the case very plainly when he said that *shells were of no avail at all against plated ships,* and that the solid shot of the 110-pounder rifled gun is not effective against such iron vessels. But late experiments at Shoeburyness, in which the "Warrior" target was pierced and shattered by shell at 600 yards, have proved that the case, as put by Sir William Armstrong, must have been based on his experience of shells that were not made of the proper form nor of the proper material, and on his experience of rifled guns that were unable to propel their projectiles with the requisite velocity.

Three conditions may be laid down as necessary to enable artillery to attack successfully armour plate defences. First—the projectile must be of the proper form; second—of the proper material; and, third—be propelled from a gun able to give it the necessary velocity. The artillery of the Ordnance Select Committee failed, because they utterly neglected the first two conditions, and had recourse to the brute force of the smooth-bore for the third. The expression accepted as representing the penetrating power of shot was "velocity squared, multiplied by weight;" but the form of the shot, and the material, were conditions altogether omitted from the expression; and the importance of the omission will be obvious, if we take an analogous case—say that of a punching machine employed to perforate wrought-iron plates. What would be the result, if the punch itself, which is made of suitable shape and material, were removed, and a round-headed poker of brittle cast iron, or soft wrought iron, were substituted in its place? The great importance of sufficient velocity is conceded—it is a *sine quâ non* condition. But has there not been great misconception in supposing that the old smooth-bore gives a greater initial velocity than the rifled gun? The results obtained will show how this is. The average inital velocity of the 68-pounder is, in round numbers, 1600 feet per second, with a charge of powder $\frac{1}{4}$ the weight of the shot, the length of the shot being of course one calibre. Sir William Armstrong stated that, with a charge of powder $\frac{1}{4}$ the weight of the shot, he obtained, with his rifled gun, an initial velocity of 1740 feet per second. He did not state the length of his projectile. Mr. Whitworth, with a projectile one and a

half calibres long, obtains an initial velocity of 1900 feet per second; and with a projectile one calibre long, like that of the smooth bore, an initial velocity of 2200 feet per second, being greater than that of the smooth-bore in the proportion of 22·16. The reason why, under nearly similar conditions as to charge and length of projectile, the rifled gun can obtain an initial velocity superior to that of the smooth-bore, must be ascribed to the action of the first condition I ventured to lay down as necessary. The rifled projectile, as compared with the spherical, has a form which is better adapted for flight, and fits more accurately the bore of the gun, so that the gases of explosion exert a greater pressure upon it while propelling it through the barrel. In practice, the initial velocity of the rifled projectile is lower than that of the smooth-bore, because, with the rifled gun, the charge of powder used is much less, while the projectile is much longer and heavier, and has a greater *vis inertiæ* to be overcome at starting than that of the smooth-bore. If very large charges be used with the rifled guns, and long projectiles, with the view of obtaining increased velocity, the strain becomes too great for the guns to bear: but if rifled guns are fired with charges so low that they are not made to perform half the work they ought to do, then, though the defects of weak construction may not be made patent by the gun being destroyed, they are very plainly manifested by the weak results of their projectiles fired against armour plates. It is proved, by well known results, that the constructors of the 110-pounder rifled gun now adopted in the service, do not dare to make the gun perform its full work, but, on the contrary, they find themselves forced gradually to reduce their charges, until they are beaten by the old smooth-bore they undertook to supersede. The only conclusion that can be drawn from this fact is, that the gun is weak in construction, and the projectile used with it is defective in principle.

The power of the smooth-bore, with its large windage, to fire large charges, and thereby obtain great initial velocities, has procured it many advocates; but Mr. Whitworth's experiments have shown that, if length of projectile be given up, which may be looked upon as the price to be paid for increased velocity, he can get an initial velocity much greater than that of the smooth-bore. But is the result worth the price paid? Not if a more efficient compromise can be obtained. I use the word compromise advisedly, because I think that every one who has had experience in artillery practice will agree with me, that the best results are only to be obtained by means of the best compromise. You cannot have long projectiles and very high velocities, without burning too much powder, and taking too much out of your gun, or else making it an unwieldy monster.

The problem we have placed before us now is, how can artillery be best adapted for attacking armour defences? The advocates of the smooth-bores are satisfied with one condition—high velocity. Mr. Whitworth objects, and says:—"If velocity were all that is needed, I can get more than you do, in the proportion of 22 to 16; but to sacrifice all to velocity is a bad compromise to effect a solution of the penetration problem. You set down velocity as *greatest possible*, form of projectile of *no account*, material of *no account;* and, after all, can do nothing at an ordinary fighting range, while you wrongly take it as proved that '*shells are of no avail*' against iron-plated ships. It will

be a far better compromise to be satisfied with a lower velocity,—getting, however, all you can at a fair cost, and combining therewith conditions *one* and *two*, proper form, and proper material for the projectile."

Let us now compare the actual results obtained in the way of penetration by the Armstrong 110-pounder, the proposed naval gun, the old 68-pounder smooth-bore, and the two naval Whitworth guns lately fired at Shoeburyness.

Guns.	Range, Yards.	Projectile.	Powder Charge.	Penetration into Armour Plates.
Armstrong 110-Pr. (7 inch bore)	200	110 lb. solid	14 lbs.	1½ to 2 inches.
68-Pr. Smooth Bore	200	68 lb. solid	16 lbs.	2¼ to 3 inches.
Whitworth 70-Pr. (5½ inch bore)	200	70 lb. shot and shell	12 lbs.	Through Plate and Backing.
Whitworth 120-Pr. (7 inch bore)	600	130 lb. shell	25 lbs.	Through Plate and Backing.

The first two results will lead every one to the same conclusion that it is to be presumed they led the Ordnance Select Committee, when they so eagerly re-adopted the smooth-bore, viz., that the Armstrong rifled gun is a worse compromise than the old gun it was intended to supersede. The reason may be inferred from the results to be, that besides neglecting conditions *one* and *two*, form and material of projectile, it is very much behind in respect of condition *three*, velocity—this is to be attributed to the defective construction of the gun, which cannot fire with safety efficient charges of powder, and to the use of the lead-coated projectiles. Taking all the results, they show themselves to be indisputably in favour of the Whitworth,—the old 68-pounder smooth-bore coming second, and the Armstrong rifled gun last.

Let us now examine how they stand in regard to velocity, as shown in the following table, which, like the one given above, is compiled from official sources.

Guns.	Charge.	Velocity.
68-Pr.	16 lbs.	Initial 1600 feet per ″.
Whitworth 70-Pr.	12 lbs.	Initial 1350 feet per ″.
Whitworth 120-Pr.	25 lbs.	At 600 yards 1260 feet per ″.
Armstrong 110-Pr.	14 lbs.	Initial 1210 feet per ″.

With regard to initial velocity, therefore, the order of the guns may be taken, with the charges used, to be—first, 68-pounder; second, Whitworth; third, Armstrong. It is worthy of notice, however, that the velocity of the Whitworth 120-pounder, after traversing 600 yards (a good fighting range), was found actually to be 1260 feet; whereas the initial velocity of the Armstrong is only 1210 feet.

The total results in respect of penetration proving themselves to be so decidedly in favour of Whitworth—who combines with condition *three*, viz., sufficient velocity, conditions *one* and *two*, proper form and material of projectile—it follows that his must be the best compromise. The slight inferiority in initial velocity of his rifled gun, with its ordinary charges, as compared with the smooth-bore, is more than compensated for by employing a projectile of proper form and material; this is shown by the penetration being through and through both plate and backing in the case of the Whitworth, while it is barely half through the armour plate in the case of the smooth-bore, and not half through in the case of the Armstrong gun.

The form of projectile employed by Mr. Whitworth for penetrating armour plates is like the one now before the section. It has a flat front, the centre being slightly rounded: the middle part of the projectile is rifled hexagonally, like the bore of the gun; the front and rear of the projectile are made of the requisite taper—to allow the air displaced in front to close in readily behind—a form which gives a great increase of velocity as compared with the form parallel throughout, as I endeavoured to explain to this section, in a paper I had the honour of reading at its meeting last year.

The material of which the projectile is composed is what is termed homogeneous iron, combining the toughness of copper with the hardness of steel. It is made hard enough to penetrate the wrought-iron plate, but not so hard as to be brittle and break up when the projectile strikes against its surface. The advantage of the flat front as compared with a pointed front is apparent, when it is considered that when the flat front strikes a plate, the whole resistance it meets with is that offered by the area of the plate covered by the flat front, in a direction in line with the axis of the impinging projectile. It consequently punches out a clean hole with a sudden impact. In the case of a pointed shot, as soon as the point begins to penetrate, the inclined sides begin to push aside the particles of the plate in a lateral direction, and an accumulating lateral resistance is offered by every part of the plate whose particles are disturbed; the passage of the shot is thereby gradually retarded, if not altogether arrested. It has been thought that the flat-fronted projectile will glance from the surface of an inclined plate like a round projectile. This is not found to be the case, as is proved by the plate now shown to the section, which was completely penetrated by a flat-fronted projectile when inclined at an angle of 37° to the perpendicular.

The Whitworth penetration shell, whose destructive power was shown by its penetrating and shattering the Warrior target at Shoeburyness, has the same form outwardly, and is made of the same material (homogeneous iron) as the flat-fronted solid projectile which has already been described. A cavity of suitable shape is formed in the projectile, of the size required to contain the bursting charge of ordinary powder. The rear of the shell is entirely closed by a screwed plate or cap. A sufficient thickness of metal, disposed in the required form, is left for the front of the shell. The uncertain complications of percussion fuses, and even the simpler time fuses, are wholly dispensed with. No fuse, or detonating substance of any kind, is used. On firing his shell through iron plates, Mr. Whitworth found that, by the

force of impact and friction, sufficient heat was generated to fire the bursting charge without any fuse at all. In practice, the action upon the powder was found to be even too rapid. To retard its action for the time necessary to enable the shell to effect a complete penetration and then to burst, Mr. Whitworth interposes between the metal of his shell and his bursting powder charge a substance that is a non-conductor of heat; by preference he encloses the powder in a flannel case, and finds that by simply diminishing or increasing the thickness of his flannel, he can burst his shell in the armour plate, or in the timber backing, or after it has passed through both. The fragments of the shell now before the section are those of one which was fired through this armour plate, and which burst and shattered this backing of timber, nine inches thick, placed behind the plate. There is one point in connection with the Shoeburyness trials that should be particularly noticed, and it is this—that all the previous experiments against iron plates have been confined to the short range of 200 yards. At longer distances the smashing monster smooth-bores cannot be made to hit the mark, whereas Mr. Whitworth has proved that at a good fighting range of 600 yards he can hit his mark to an inch, and can at that distance, and, there is good reason to believe, at twice that distance, send his shells through the "Warrior's" sides. That 600 yards may be fairly called a good fighting range will be admitted, when we remember that the brave "Agamemnon" at Sebastopol fought all the guns of Fort Constantine at a range of 500 yards, and the "Albion" signalled, "Well done, 'Agamemnon,' where you lead we will follow." With regard to the 120-pounder gun itself, it should be explained that it was made at Woolwich, under the able superintendence of Mr. Anderson, at Mr. Whitworth's own request, and according to special drawings supplied by him. It has the same bore (7 inches) as the Armstrong 110-pounder, so often tried against the "Warrior" target, and found, as Sir W. Armstrong said, "not to be effective." It is a built-up gun, and its hoops are made of coiled iron welded; but that method of manufacture was adopted by Mr. Whitworth in the first built-up gun that he made, and by many other makers of guns several years ago. Mr. Whitworth has since employed, by preference, the homogeneous metal, which he found to answer perfectly for small arms and field guns, as well as for the penetration shells which have been described.

Practical improvements have been made in the process of forging and annealing the metal, which enable it to be worked in masses of any required size, whose quality may be henceforth depended upon with certainty. The Whitworth heavy guns are now being made with both interior tubes and outer hoops of homogeneous metal of the improved manufacture, so that the guns will be constructed throughout of one uniform metal, without any welding at all. Experience justifies the expectation that they will be free from the objections which it is well known are inherent in all welded guns, and be fully able to resist the severe and searching strain which is sure, sooner or later, to disable a gun built up of forged coiled tubes, if it be called upon to do its full work by discharging heavy rifled projectiles at the most efficient velocities.

"*The economic effects of the recent gold discoveries*," by Mr. Henry Fawcett.

The author commenced by alluding to the confident predictions which were made when the rich gold deposits of Australia and California first became known, that the value of this metal would be rapidly and largely depreciated. Governments were advised to change the standard of value from gold to silver, and fundholders, and others who were in the receipt of a fixed money income, were greatly alarmed at the prospect of a general rise in prices. All were ready to admit that these confident predictions have not been realized; for the depreciation in the value of gold cannot as yet have been very marked, since the highest financial authorities still dispute whether the new supplies of gold have produced even a small alteration in its value. Mr. Fawcett then proceeded to sketch the plan of his paper, and said that, in the first place, he should explain the nature of the evidence which was required to determine the effect which was exerted on general prices by increased supplies of gold. He should then point out the principal modes in which the additional gold had been absorbed. This would lead him to remark upon the circumstances which would chiefly determine the effects which in future years would result from this increased production of gold; and, finally, he would remark upon the manner in which the progress of Australia and California had been assisted by the gold discoveries. Mr. Fawcett then stated that, in the year 1848, the aggregate value of the gold existing throughout the world was £560,000,000, and so great had been the yield of gold from Australia and California, that, if this present yield continued, these two countries would, in thirty-five years, produce gold equal in value to the entire quantity which previously existed. Previous to 1848, the entire annual production of gold did not exceed £6,000,000: the amount yielded by Australia and California had been, in many years, four times as great as this, and therefore it was very naturally supposed that gold must be depreciated in value. A large portion of these new supplies of gold was sent to England, and we must employ the gold thus obtained in one of the three following ways:—1. In arts or manufactures; 2. In increasing our gold currency; 3. In re-exporting the gold to foreign countries. The amount of gold employed in arts or manufactures is so small, that this source of absorption may be neglected in comparison with the remaining two. It had been stated in Mr. Tooke's "History of Prices," that from 1848-56 our gold coinage has increased by £20,000,000. Mr. Fawcett then proceeded to explain with great care the connection between general prices and the quantity of money in circulation; and he affirmed that, if the population and wealth of a country increased, the value of gold must rise—or, in other words, general prices must decline, unless an increased amount of money is brought into circulation. A great portion of the buying and selling of the country is, however, carried on by cheques, bills of exchange, and various other instruments of credit, which serve as substitutes for money. The extended use of these substitutes for money of course supplies the place of a metallic currency, and therefore it is almost impossible to arrive at a conclusion whether or not the £20,000,000 added to our gold coinage in 1856 was sufficient to preserve a uniformity in

the value of gold, while the population and wealth of the country was increasing so rapidly as it did during those years. In the first place, the amount of this increase of wealth cannot be ascertained; and, secondly, some of the substitutes for money may be more largely used. For instance, many trading transactions, in which money was formerly used, are now carried on by cheques. Mr. Fawcett next inquired whether a comparison of general prices now with what they were previous to 1848, would more accurately ascertain than the method just alluded to, whether or not the value of gold has been depreciated. When this comparison was made, they were at once perplexed by observing that the price of many commodities had declined, whereas the price of others had risen. But these changes in price could be accounted for independently of any change in the value of gold. For instance, many manufactured articles had become cheaper, because improved methods of production had been introduced; and, on the other hand, meat and dairy produce had become dearer, in consequence of the increased demand of a larger population. It was therefore proved that the depreciation in the value of gold could not as yet have been very marked, since it was not evidenced by a decided effect on general prices. From this negative result a most important conclusion could, however, be deduced; for it was evident, if the large supplies of gold had not depreciated the value of this metal, that then its value must have been greatly and rapidly depreciated if these supplies had not been forthcoming. Mr. Fawcett then referred to the curious coincidence that when Europe was changing from feudal into commercial Europe, the gold of South America was discovered, and facilitated the change, and the new supplies of gold have assisted the commercial progress which has been due to free trade. The great increase in our trade and commerce since 1848, showed how largely the wealth of the country had been augmented, and if, therefore, more gold had not been forthcoming, a great and sudden rise must inevitably have occurred. The consequences of this must have been most disastrous, for the terms of every money contract would be changed. Mr. Fawcett then said the East had really absorbed the greater portion of the additional gold which had been produced. Our exports, both from India and China, had enormously increased; large amounts of capital had been sent from this country to India, for the purpose of carrying out public works, but our imports from those countries, especially China, showed no corresponding increase. The consequence of this was, that the balance of trade was so largely against this country, that an amount of specie, varying from £10,000,000 to £14,000,000, had for some years been annually exported to the East. The principal portion of this specie had been silver, and the silver had been, to a great extent, supplied from the currencies of France and other countries. Gold has taken the place of this silver, and therefore the East had caused a large portion of the additional gold to be absorbed. No one could confidently predict how long our Eastern trade might continue as it is now. The Chinese might some day prefer to import our manufactured goods instead of being paid by us in specie. If such a change occurred, the export of specie to the East would have ceased, and then, no doubt, such an amount of gold as we had been obtaining from India and China, could not be absorbed in Europe without a depreciation in its value. Mr. Fawcett, therefore, concluded that, although the

balance of evidence was, on the whole, in favour of the opinion that the value of gold would not for a long time be depreciated, yet such a depreciation might very possibly occur, and therefore prudence would dictate that it should, as far as possible, be considered in making any permanent arrangements which involve fixed money payments. Mr. Fawcett next disputed the arguments maintained by Chevalier, that if the fundholders' property should be depreciated by a change in the value of gold, then they would have a claim to compensation from the Government. Such an idea ought not for a moment to be encouraged; for the change in the value of gold, if it should come, had been so long delayed, and was still so uncertain, that every one had time to take warning. Mr. Fawcett concluded his elaborate paper by showing that the gold discoveries had acted more powerfully than any other cause could have done to attract capital and labour to Australia. Few branches of industry could in the infancy of a colony be carried on with success, because labour was scarce, and various other appliances, such as roads, &c., were required. The thousands who were attracted to Australia by the gold discoveries soon created a supply both of labour and capital, and the commercial prosperity of that country was immediately created.

Mr. THORNTON read a paper on the "*Income Tax*," the object of which was to show that every income tax whatsoever must necessarily violate the just principles of taxation, and that an uniform income tax does so to an unnecessary extent. The principles of taxation being assumed to be those laid down as such by Adam Smith, the writer pointed out that the income tax is collected in the most objectionable manner, placing the contributor on the rack, and leaving him no alternative but to criminate or perjure himself; that it is collected at the expense of national honesty, it being evident from the Parliamentary returns that a large majority of commercial and professional men do habitually make false declarations as to the amount of their income; and that it is levied in proportion, not to ability, but to honesty,—favouring the dishonest, and falling with full weight on the honest. Then an uniform income tax was represented to possess, over and above the injustice common to every income tax, an injustice peculiar to itself, by taxing equally all incomes of equal amount, without reference either to the varying amount of claims upon those incomes, or to the question whether their source be precarious or permanent, and consequently without reference to the varying ability of the recipients of the incomes to bear taxation. Objections to the substitution of a discriminating to an uniform income tax were then examined; the writer adopting Mr. Mill's suggestion, that the proportion of income which ought in prudence to be saved should be exempted, and contending that such an exemption would unduly benefit neither the rich nor the poor, but would tend to bring the taxation of both classes more within their respective abilities, and that, although it would undoubtedly give to a few spendthrifts an advantage which they do not deserve, it would, on the other hand, secure to a multitude of economists the reward which their thrift and foresight do deserve.

Mr. FREDERICK PURDY read a paper on "*Local Taxation and Real Property.*"

The writer endeavoured to give a complete statement of the sum now annually raised in the United Kingdom as local taxes,—discriminating the portion of the charge which is borne by real property from that incident upon other descriptions. As regards England and Wales, the most important of the local taxes is the poor rate, which, after deducting the amount collected with it as county, borough, and police rates, leaves, according to the latest returns, £5,996,000, and which is chiefly applicable to the relief of the poor; county, borough, and police rates, £1,925,000; borough rates, raised separately and in addition, £312,000; highway rates, £2,066,000. Church rates in 1861 amounted to £233,000; rates under the Metropolis Local Management Acts, £788,000; Metropolis Main Drainage, £161,000; burial board rates, £103,700; local boards, £851,000; these, with five or six smaller rates, constitute an aggregate of £12,582,000, chargeable on real property. The rates incident upon other descriptions of property are—turnpike tolls, £1,126,000; harbours, £1,201,000; and Trinity House dues, £288,000; total, £2,615,000. Mr. Purdy thought that in some respects the returns were defective, but they showed that £15,197,000 had been raised in one year for local purposes. In regard to Scotland, the poor rate is £629,000; prison assessment, £36,000; turnpike tolls, £233,000; northern lights, £60,000; these, with a few other rates, give a total of £1,036,000. Then, with respect to Ireland, the poor rate and medical charities are £689,000; the grand jury presentments, £1,035,000; Dublin police, £38,000; and Dublin ballast board, £47,000; total, £1,779,000. The grand total of local taxation for the United Kingdom is, therefore, £18,012,000. Of this amount, £15,056,000 is a tax upon real property. Besides this charge, it is estimated that, in one shape or the other, real property pays to the imperial exchequer every year £9,450,000. Now, the annual value of real property is £131,680,000; upon that sum the local taxation is equal to 2*s.* 3½*d.* in the pound, the imperial taxation 1*s.* 5¼*d.*, together 3*s.* 8¾*d.* Mr. Purdy observed, that the local taxation was as necessary to the maintenance of the kingdom as the imperial revenue; that five-sixths of the local taxation is paid out of real property, and that the schemes mooted for a re-adjustment of the Income and Property Tax Acts would have the effect, if carried into practice, of placing an additional load upon a description of property already overburdened.

THE FLOW OF GOLD.

UNDER this head, our contemporary, *The Scientific American*, has the following sensible remarks upon the approaching United States' monetary crisis; thus showing that some, at least, of the leaders of public opinion are not blind to the fearful commercial straits which an unlimited issue of paper money must necessarily create.

"Gold is now selling in Wall-street at 22 per cent. premium, and exchange on England at 135 per cent. The premium on gold is simply

another term for the depreciation of our paper currency; the quotations might as well be, paper money 22 per cent. discount, exchange 13 per cent. premium. This makes exchange about 4 per cent above par. An old act of Congress fixed the value of the pound sterling at 4 dollars 44 cents, while its actual value is a little more than 4 dollars 84 cents, so that exchange, when at par, is nominally at about 9 per cent. premium. It is now nominally at 13 per cent. premium above gold, which is really 4 per cent.

"If Mr. Grinnell sends 100,000 dollars' worth of corn to England, and has it sold there, he wants to get the pay for it to New York. At the same time Mr. Stewart buys 100,000 dollars' worth of cloths in England, and he must send the pay for them from New York to England. In a simple state of society, Mr. Stewart would send his gold across the Atlantic in one direction to pay for his cloths, while an equal amount was coming in the opposite direction to pay Mr. Grinnell for his corn; but this expensive, risky, and useless transportation of gold to and fro across the ocean is avoided by a simple arrangement between the exporter and the importer. Mr. Stewart takes his gold to Mr. Grinnell, who gives him in exchange an order on the agent in England, for the money obtained by the sale of the corn. This order is called a Bill of Exchange.

"When the imports of any country just equal its exports, bills of exchange will find just as many buyers as sellers, and they will be sold at par, but if the exports do not sell for enough to pay for the imports, then some specie must be sent abroad to settle the balance, and importers, sooner than pay the freight and insurance on this specie, will pay a moderate premium on bills of exchange. Four per cent. will fully cover the cost of shipping gold, and, consequently, this is as high as exchange can go above the price of gold. By simply looking, therefore, at the money market reports in the papers, we are enabled to know that all the gold which is offered in market is being bought and shipped abroad.

"The outward flow of gold from this country at the present time results from two causes—one permanent, the other temporary. The permanent cause is the production of gold in California; the temporary cause, the large issue of irredeemable paper by the Government.

"When any country is producing more than its share of currency, the surplus will be distributed throughout the commercial world. This distribution is effected, like nearly all of the other operations of commerce, through the medium of prices. Currency is the measure of values. When there is a great deal of currency, in proportion to other things, prices will generally be high. If prices are high in any country, that country is a good place to sell things, and merchandise is consequently imported for sale; at the same time it is a poor place to buy things for export, and there is accordingly an excess of imports over exports, leaving a balance to be settled by the exportation of specie. When it was seen, in 1849, that California would produce annually a large amount of gold, the writer of this told his commercial friends, that as long as we produced more than our share of the specie product of the world, the rate of exchange would be generally against this country—enough of the time to carry abroad the surplus over our share. The currency of the world is drawn to its natural level all over the

globe by a law as universal and irresistible as the force of gravitation which levels the water of the sea.

"The temporary cause of the outflow of gold is the excessive issue of irredeemable paper by the Government. Our currency is worth nothing to foreigners, while by our own people it is regarded as more valuable than anything which they have to sell. Specie, on the other hand, is the only portion of our currency with which we can pay our debts or purchase commodities in other countries. Our specie, being worth more for use in foreign commerce than in domestic trade, is appropriated to its most serviceable use: it is shipped abroad. This movement, too, is effected through the medium of prices. The Canadian who brings a drove of horses for sale to our Government, as he cannot pass our paper money at home, buys gold to take back with him. The puffing up in prices brings a flood of imports from all quarters, making an excess above our exports to be paid in specie.

"At the present time we are exporting, not merely the excess above our share of the California product, but we are sending abroad a large part of the specie portion of our currency—this being displaced by the Government paper."

The following is a later article from the same source, entitled—

PAPER MONEY AS A GOVERNMENT RESOURCE.

"By the census statistics of 1860, the aggregate property in the United States amounted to sixteen thousand millions of dollars. The bank notes in circulation amounted to two hundred and seven millions, and considering that in the Pacific States the currency has hitherto been exclusively metallic, there may have been enough specie in circulation to make the whole money of the country three hundred millions of dollars, which is less than two per cent. of the whole property of the community.

"A portion of the sixteen thousand millions of property belonging to the citizens of the country consisted of gunpowder, flour, beef, &c., and of this the Government wanted one thousand millions of dollars' worth to carry on the war. How was the Government to obtain possession of this property?

"A portion of it the Government was able to borrow, promising to return an equal value at some future time. There were numerous individuals in the community who had property which they could not use to advantage, and they were willing to loan it to the Government. This property existed mostly in the form of merchandise, but it was not for the most part in the kind of merchandise which the Government wanted, so the exchange was effected, like other exchanges of property, through the medium of money. The holders of the property sold it for money, and loaned the money to the Government, and then the Government exchanged the money for the merchandise which it needed. The only office which the money performed was to effect the exchange of the commodities. Pieces of green paper and little discs of gold and silver are of no more service in battle than pebble stones.

War cannot be carried on by means of money, unless the money can be exchanged for the needed commodities.

"A second mode in which the Government could obtain a portion of the property of the citizens was by taxation—simply seizing it by means of the physical force which was under the direction of the authorities.

"The third plan adopted was the issuing of notes of the Government, designed to circulate as money; it being supposed that any persons who owned gunpowder, horses, or any other property which the Government wanted, would willingly give their property in exchange for these notes. What was the effect of this measure?

"As payment was refused by the banks on the two hundred millions of their notes, and as the Government did not redeem its notes, the two circulated together, swelling the amount of our currency. This led to a general advance in prices. Every thing which the Goverment now buys it must pay 33 per cent.—the present premium on specie—more for than it would if the currency had not been disturbed. As the other loans to the Government are also being paid in this depreciated currency, while they will be repaid in coin, the whole accruing debt is swollen to the same extent. The debt is contracted with one measure of value, to be repaid with another, and the change is against the Government. This issue of small notes, making them a legal tender, is in fact a forced loan, and of all modes of obtaining the property of the citizen, it is the most costly to the Government, and one of the most disastrous to the people. It operates in precisely the same manner as a debasement of the coin—a measure repeatedly adopted by feeble tyrants, and which has always proved exceedingly injurious wherever it has been tried. The money belonging to any community forms a very small part of the total property of the community, but it is an exceedingly important part. It is the measure of all values and the basis of all contracts. No other act can introduce so general confusion into the industrial operations of a community as an alteration of the value of the currency. This act impairs the obligations of all contracts, and overthrows all prospective calculations.

"The experience of France with the issue of *assignats*, that of James II. with his brass guineas, that of this country with its continental currency, and that of many other nations, have demonstrated that, when the currency has been depreciated beyond a certain limit, it will be refused in the exchange of commodities, and will cease to perform its office.

"Desiring the suppression of the rebellion and the salvation of the country as warmly as the safety of our own lives, we yet warn the administration to devise other means for obtaining the property which it needs than the unlimited issue of 'green-back notes.'"

Provisional Protections Granted.

1862.

[*Cases in which a Full Specification has been deposited.*]

2536. Edouard Astel, of Paris, for improvements in urinary utensils; also applicable to fixed and portable commodes.—[*Dated September 16th.*]

2602. William Clark, of Chancery-lane, for improvements in signalling,—being a communication.—[*Dated September 24th.*]

2612. Marc Antoine François Menons, of Paris, for improvements in the construction of chair settees,—being a communication. — [*Dated September 25th.*]

2656. George Haseltine, of Fleet-street, for improvements in the means for, and mode of, warming and ventilating buildings,—being a communication.—[*Dated October 1st.*]

[*Cases in which a Provisional Specification has been deposited.*]

1426. Charles James Neale, of High Oakham, Nottinghamshire, for improvements in apparatus for measuring and registering corn and other grain.—[*Dated May 12th.*]

1516. Timothy Morris and Robert Weare, both of Birmingham, and Edward Henry Cradock Monckton, of Fineshade, Northamptonshire, for improvements in obtaining and applying light and heat by electricity.—[*Dated May 19th.*]

1548. Paul Rapsey Hodge, of Token-house-yard, for an improved dinner, supper, breakfast, or dessert plate.—[*Dated May 22nd.*]

1562. Alexander Samuelson, of Cornhill, for improvements in the working of hydrostatic presses, and in the apparatus employed therein.—[*Dated May 23rd.*]

1648. Thomas Tipping Lawden, of Birmingham, for improvements in certain descriptions of single and double-barrelled guns. — [*Dated May 31st.*]

1806. Henry Rushton, of Northampton-road, Clerkenwell, for improvements in plaiting machines to plait cotton, yarns, silk, or like fibrous materials.—[*Dated June 19th.*]

1816. Jean Baptiste Theophile Detuncq, of Quesnoyle Montant, France, for improved apparatus or machinery for treating flax or hemp.—[*Dated June 20th.*]

1835. Henry Gonnon, of Saint Nazaire, France, for improved machinery for making bricks.—[*Dated June 21st.*]

1878. Jules Martin, of Route de Bordeaux Perigueux, France, for improvements in reaping and mowing machines.—[*Dated June 26th.*]

2012. Daniel Bateman, of Low Moor, near Bradford, for improvements in the manufacture of card cloth used for carding wool and other fibrous substances.—[*Dated July 12th.*]

2071. William Edward Gedge, of Wellington-street, Strand, for improved excavating or boring apparatus,—being a communication. — [*Dated July 21st.*]

2127. Joseph Walton, of the Strand, and James Moore, of Upper Berkeley-street, Portman-square, for improvements in the mode of ventilating and heating rooms, Turkish baths, hothouses, and buildings of all kinds.

2129. Charles Walter Eddy, of Warwick-terrace, Belgrave-road, for improvements in the means of impeding the entrance of ships and vessels, and in particular of screw ships, into channels.

2133. Theodore Antoine Favrichon, of St. Symphorien de Lay, Loire, France, for an apparatus for the speedy and economical heating of baking ovens, and also for using their excess of heat.

The above bear date July 28th.

2146. James MacKenzie, of Arundel-square, Islington, for improvements in shaping machines for curvilinear surfaces.

2154. Edward Beel Clark, of Lower Polgooth, Saint Ewe, Cornwall, for

improvements in the manufacture of candles, and in apparatus employed therein.

The above bear date July 29th.

2157. Ferdinand Charles Warlich, of Alma-terrace, New Cross, for improvements in machinery for dressing and shaping stone,—being a communication.—[*Dated July 30th.*]

2183. Robert Nurse, of Machen, near Newport, and David Nurse, the younger, of Pontymister, both in Monmouthshire, for an improved annealing pot.

2185. Charles Henry Plevins, of Dunstan Hall, Derbyshire, and Henry Rider, of Rotherham, for improvements in the construction of colliery waggons, tubs, or corves, and in apparatus for tipping or discharging the same.

The above bear date August 1st.

2197. James Higgin, of Manchester, for an improved substitute for cow-dung used in printing and dyeing textile fabrics or yarns. — [*Dated August 5th.*]

2211. Alfred Thiriez, of Lille, France, for a new machine for glossing and glazing all thready fabrics.

2212. François Henry Marie Côme Damiens Chevalier de Fenis de Lacombe, of Paris, for improvements in the means of lighting towns or other localities, and of ventilating, warming, and providing the same with water.

The above bear date August 7th.

2232. John James Henry Gebhardt, of Lawrence-lane, for an improved fastening for purses, pocket books, needle books, ladies' companions, instrument cases, and other similar articles,—being a communication.—[*Dated August 9th.*]

2244. Thomas Lancelott, of Birmingham, for improvements in the manufacture of ornamental chains from sheet metal.—[*Dated August 11th.*]

2299. James Barclay, of Gravel-lane, Southwark, for improved machinery for the manufacture of nails.—[*Dated August 15th.*]

2317. Julian Brière, of Brussels, for a continuous self-acting condenser, being a new boiler-feeding apparatus.

2318. Henning Boetius, of Roehampton-street, Pimlico, for improvements in fire-proof materials.

The above bear date August 18th.

2327. William Whittle, of Smethwick, for improved machinery for the manufacture of nails and spikes.

2329. Henry Whittaker, of Church, near Accrington, for improvements in healds or heddles, and in the manufacture of the same.

The above bear date August 20th.

2336. Matthew Wilkinson, of Blackburn, for improvements in carding engines; parts of which improvements are applicable to drawing and such like frames.

2339. Adolphe Boubée, of Paris, for improved apparatus for casting or moulding glass, and imitating precious stones or marbles.

The above bear date August 21st.

2348. Harper Twelvetrees, of Bromley, for improvements in the preparation of washing powders, soap powders, and cleansing crystals.—[*Dated August 22nd.*]

2354. John Edwards, of Aldermanbury, for improvements in the permanent way of railways.—[*Dated August 23rd.*]

2362. Hugh Prichard Hughes, of Salford, for improvements in the construction of sawing machines.

2363. William Edward Gedge, of Wellington-street, Strand, for improvements in stays or corsets,—being a communication.

2364. Joseph Harrison and Benjamin Harrison, both of Otley, for improvements in clod-crushers.

2365. George Davies, of Serle-street, Lincoln's-inn, for improved machines for washing skeins of cotton, linen, wool, or silk,—being a communication.

2367. Leon Iarosson, of la Madelaine, France, for an improved process and machinery for bleaching or washing textile fabrics and materials.

The above bear date August 26th.

2371. George Davies, of Serle-street,

Lincoln's-inn, for a machine for singeing woven fabrics of cotton, wool, or silk, by means of gas or alcohol,—being a communication.

2375. William Henry Turner, of Blackburn, for improvements in machinery or apparatus for carding cotton and other fibrous materials.

2376. Charles Clark, of the City-road, for improvements in tea and other trays for the table, and in urns and apparatus intended to be used therewith.

2377. George Lindsay, of Belfast, for an improved mode of arranging and disposing guns in ships employed in naval warfare and otherwise.

2379. Richard Archibald Brooman, of Fleet-street, for improvements in machinery for separating or sorting and washing coal and other minerals,—being a communication.

2381. John George Nutting, of Regent-street, for an improvement in the manufacture of buttons.

2383. Harry Whiteside Cook, of Norwood, for improved apparatus for obtaining motive power applicable for driving machinery, or for other purposes where a motive power is required.

The above bear date August 27th.

2385. Joseph Kitchen, of Liverpool, for improvements in ventilators.

2389. John Jacob Moeckel, of Rouen, for improvements in machinery or apparatus for spinning cotton, wool, or other fibrous materials.

2391. William Husband, of Hayle, Cornwall, for improvements in water-valves.

2393. Charles Humfrey, of Suffolk-grove, Southwark, for improvements in the treatment of petroleum to render it non-inflammable.

The above bear date August 28th.

2395. Henry Jones, of Birmingham, for improvements in breech-loading fire-arms.

2397. William Smith, of Salisbury-street, Adelphi, for improvements in the construction of furnaces,—being a communication.

2399. Henry Harben, of Oxford-villa, Haverstock-hill, for improvements in the manufacture of cotton, cotton fibre, and other similar fibrous productions.

2401. William Owen, of Rotheram, for improvements in the manufacture of railway wheels and tyres, and in securing tyres to wheels.

2402. Philip Wallace Mackenzie, of Jersey City, New Jersey, and Stephen William Smith, of Brooklyn, New York, for improvements in vehicles to be propelled by the rider.

2403. Reginald Courtenay, of Kingston, Jamaica, for improvements in obtaining motive power.

2405. Edmund Alfred Pontifex, of Shoe-lane, for improvements in steam traps or apparatus for facilitating the escape of condensed steam.

The above bear date August 29th.

2407. Edward Charlton Harding and Charles Doody, both of Manchester, for improvements in braces.

2410. John Henry Johnson, of Lincoln's-inn-fields, for improvements in coating or covering metallic surfaces with copper,—being a communication.

2411. John Meyer, of Kennington, for improvements in mechanism for the production of jacquard cards, and in the said cards or card-bands.

The above bear date August 30th.

2412. John Gay Newton Alleyne, of Alfreton, Derbyshire, and Julius Roberts, of Essex-court, Temple, for improvements in the manufacture of flanged wrought iron or steel plates, and of wrought iron beams and frames of a trough-shaped section, and in the apparatus employed for that purpose.

2413. John Nickson and Thomas Waddingham, junior, both of Manchester, for an improved foundation or groundwork for plaster for ceilings, walls, partitions, and other purposes.

2415. William Edward Gedge, of Wellington-street, Strand, for improvements in apparatus for washing the felts of paper-making machines,—being a communication.

2417. James Whitehead, of Newton Moor, Cheshire, for improvements in

machinery or apparatus for preparing, spinning, and doubling cotton, wool, and other fibrous materials.

2418. Edward Gerrard Fitton, of Ardwick, Lancashire, for improvements in machinery for winding yarn or thread on to bobbins or spools.

2420. William Charles Edge, of Clerkenwell, for improvements in the manufacture of Albert chains, and in the mode of securing the same to the vest of the wearer.

2421. William Clark, of Chancery-lane, for improvements in the means of obtaining light and heat, and in apparatus for the same,—being a communication.

2423. John Henry Johnson, of Lincoln's-inn-fields, for improvements in apparatus for regulating or controlling the working of motive-power engines; applicable also to the regulation of the flow of liquid air or gas through pipes or conduits,—being a communication.

The above bear date September 1st.

2425. Joseph Mosheimer, of Manchester, for certain improvements in machinery for amalgamating gold and silver, or the ores thereof.

2429. Richard Waygood, of Newington, for improvements in steam boilers.

2431. Jacob Baynes Thompson, of Moreton-place, St. George's-square, for improvements in electro magnetic machines.

2432. Sir William O'Shaughnessy Brooke, of Euston-place, for improvements in the construction of submarine telegraphic cables.

2433. Alexander Johnston, of Glasgow, for improvements in machinery for pressing cotton and other materials, and in bands for retaining the same in bales.

The above bear date September 2nd.

2435. Henry Elliott, of Birmingham, for a new or improved instrument or apparatus for extracting the cases of pin cartridges from breech-loading fire-arms, and for re-capping, re-charging, and closing or turning in the said cartridge cases.

2437. George Walton, of Bradford, Yorkshire, for improvements in circular box looms.

2439. William Clark, of Chancery-lane, for improvements in musical instruments,—being a communication.

2441. Richard Archibald Brooman, of Fleet-street, for improvements in tools for boring, and in apparatus for working the same,—being a communication.

2442. Richard Archibald Brooman, of Fleet-street, for improvements in apparatus for transmitting electric telegraph messages and signals,—being a communication.

2443. Peter John Bossard, of Kennington-road, for improvements in stoppers for bottles, jars, guns, tubes, and other open-mouthed articles, in taps, and in fixing them in casks and other vessels,—being a communication.

The above bear date September 3rd.

2444. John Cook, of Fitzroy-place, Kentish Town, for improvements in carriages.

2445. Benjamin Franklin Cowan, of Memphis, Tennessee, America, for improvements in cannon and other fire-arms.

2446. William Clark, of Chancery-lane, for improvements in the manufacture of a blue colouring matter,—being a communication.

2448. Horace Leeman Emery, of Albany, U.S.A., for improved machinery for ginning cotton.

2449. Richard Pipes Coles, of Englefield-road, Islington, for improvements in the construction of the permanent way of railways.

The above bear date September 4th.

2451. William Slater, of Little Bolton, and William Randall Harris, of Salford, for improvements in self-stripping carding engines, for preparing cotton and other fibrous substances or materials.

2452. William Edward Bovill, of James-street, Buckingham-gate, for an improvement in the mode of applying oil and other fluid lubricating matters to machinery,—being a communication.

2453. Herbert William Hart, of Fleet-

street, for improvements in argand and other burners.

2454. David Arthur Samuel, of Belvedere, Kent, for improvements in apparatus for steering vessels.

2455. John Stewart Margetson, of Cheapside, for improvements in the manufacture of the material intended for scarfs or cravats, and in the machinery employed therein.

2456. William Wells, of Ryder's-court, Leicester-square, for improvements in horse-shoes, and in the method of fastening the same.

2457. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in lamps,—being a communication.

2458. Sidney Hopton Hadley, of Upper Thames-street, for an improved process for manufacturing gas for illumination.

2459. John Robert Johnson, of Stanbrook-cottage, Hammersmith, and John Ashworth Harrison, of St. Andrew's-road, Southwark, for improvements in apparatus for taking photographic panoramic pictures.

The above bear date September 5th.

2460. Samuel Hazard Huntly, of Upper Baker-street, Regent's-park, for improvements in cooking apparatus; more particularly applicable to the requirements of the army and navy.

2461. Jacob Snider, junior, of Pennsylvania, U.S.A., for a new and useful method of increasing the durability of, and for preserving, cloths and other like fabrics used for sails, tarpaulings, tents, and other coverings; also all kinds of ropes and cables and telegraph wires; also all woods, metals, and other materials, used in buildings or constructions on land or on water; and all objects exposed to the action of acids, alkalies, gases, fire, fresh or salt water, atmospheric, or other like destructive influences, by the application of graphite.

2462. Samuel Pudney, of Manor-street, Clapham, for improvements in apparatus to be used in the manufacture of sulphuric acid.

2463. Hesketh Hughes, of Homerton, for an improved frilled and fluted fabric or material, and improvements in fluting or goffering machines.

2464. Emma Louisa Duncan, of Inverness-road, Bayswater, for improvements in the manufacture of splints.

2465. John Henry Johnson, of Lincoln's-inn-fields, for improvements in fire-arms and projectiles,—being a communication.

2466. William Joseph Curtis, of Tufnell Park-road, Holloway, for an improved construction of breech-loading cannon.

The above bear date September 6th.

2468. Charles Wye Williams, of Liverpool, for improvements in steam boilers.

2469. Frederick Dicas Artingstall, of Manchester, for improvements in balances.

2470. James Stead Crosland, of Ashton-under-Lyne, for improvements in the manufacture of tubes made of copper and of copper combined with other metals.

2471. James Whitehead, of Manchester, for certain improvements in looms for weaving.

2472. James Hartshorn and William Redgate, both of Nottingham, for improvements in means or apparatus for the manufacture of lace fabrics.

2473. Charles Fink, of Berlin, for an improved turbine.

2474. George Washington Belding, of King-street, Cheapside, for improvements in wringing machines,—being a communication.

2475. George Davies, of Serle-street, Lincoln's-inn, for improvements in railway signals,—being a communication.

2476. Alexander Jardin Alderman, of Guildford-street, Bloomsbury, for improvements in ships' windlasses, capstans, and cable stoppers, applicable generally to hauling and working with chains.

The above bear date September 8th.

2477. John Webster, of Ipswich, for improvements in preventing the incrustation of steam boilers.

2478. Peter Rainier, of Shirley, near Southampton, for improvements in

watches, chronometers, and other time-keepers.

2479. Joseph Maurice, of Langham-place, for improvements in the construction and preservation of ships and vessels.

2480. Fraser Selby, of Surbiton, for improvements in traction engines, and in valves for traction engines where compound engines are used; which latter improvements are applicable to compound engines generally.

2481. William Hirst, of Halifax, for improvements in machinery to be employed in the manufacture of paper or linen spool tubes; which machinery is also applicable for the manufacture of cartridge cases.

2482. Joseph Walker, of Norwich, for improvements in the manufacture of oil presses.

2483. Theodor Heitmann, of Iserlohn, Prussia, for improvements in the manufacture of copper from copper ores.

The above bear date September 9th.

2484. Jones Saunders, of Morden-place, Lewisham-road, for improvements in lamps.

2485. Jones Saunders, of Morden-place, Lewisham-road, for a new or improved railway break.

2486. Mark Smith, of Heywood, Lancashire, for improvements in machinery for raising the nap on woven fabrics,—being a communication.

2487. William Rothera, of Hollinwood, near Manchester, for improvements in machinery or apparatus for rivetting boiler plates, tanks, and similar articles.

2488. Frederic Hands and Henry Holland, both of Birmingham, for new or improved compositions for the manufacture of black ornaments, such as brooches, bracelets, earrings, and other ornaments usually made of jet; which said compositions may also be applied to the manufacture of various other articles.

2489. Joseph Vigouroux, of Nimes, France, for an inoxydable white metal, suitable for making taps or cocks, and other useful articles.

2490. Andrew Barclay, of Kilmarnock, N.B., for improvements in traction engines, and in apparatus for indicating the pressure of steam.

2491. George Ritchie, of Edinburgh, for improvements in extracting the liquid portion of yeast, spent hops, or other similar matters, and in the apparatus employed therein.

2492. George Tomlinson Bousfield, of Loughborough-park, Brixton, for improvements in machinery used in the manufacture of files,—being a communication.

2493. Arthur Rigg, junior, of Chester, for improvements in apparatus for carrying and tipping coal and other minerals, and in steam brakes used therewith, and with other machinery.

2494. George Tomlinson Bousfield, of Loughborough-park, Brixton, for improvements in machinery for cutting files,—being a communication.

The above bear date September 10th.

2495. William Augustus Munn, of Faversham, for an improved apparatus for capping, loading, and closing cartridges for breech-loading fire-arms.

2496. Thomas Steel, of Bradford, Yorkshire, for improvements in treating soapsuds, or other saponaceous or oily matters.

2497. George Weeks, of Bromley, Kent, for improvements in constructing frames, trays, pots, or holders for flowers, plants, or shrubs, growing or otherwise, with arrangements for their display, and also for drainage.

2498. Charles Robert Humphrey, of Old-street, St. Luke's, for improvements in printing machinery.

2499. Florimond Datichy, of Mortimer-street, for improvements in steam engines.

2501. Richard Archibald Brooman, of Fleet-street, for improvements in implements for cutting the soil,—being a communication.

2502. William Clark, of Chancery-lane, for improvements in cigar and cigarette cases,—being a communication.

2503. Louis Constant Hoyau, of Paris, for an improved portable apparatus for marking time.

2504. John Thomson, of Dundee, for improvements in the treatment of

vegetable fibres, with a view to their manufacture into textile fabrics.

2505. Andrew Barclay, of Kilmarnock, N.B., for improvements in locomotive boring and winding engines.

2506. Westley Richards, of Birmingham, for improvements in fire-arms and cartridges.

2507. John Walker and Frederick Walker, both of Leeds, for improvements in machinery for combing and carding, or hackling flax, silk, wool, and other fibrous substances.

2508. Peter Ward, of Bristol, for improvements in the manufacture of a double sulphide of calcium and sodium.

2509. Thomas Molineux, of Manchester, for improvements in pianoforte actions.

2510. Andrew Whytock, of Lansdowne-terrace, Regent's-park, for improvements in the construction of coated and uncoated sheet iron boxes, and in the mode of, and apparatus for, straightening coated and uncoated sheet iron.

The above bear date September 11*th.*

2511. Ambrose Edmund Heath Buckley Butler, of Leeds, for improvements in machinery for straightening and polishing cylindrical bars of iron and other metals.

2512. John Burns Smith, of Bury, Lancashire, for certain improvements in washing and mangling machines; applicable in part to steam dyeing and to bleaching.

2513. James Thom, of Canterbury-place, Lambeth, for improvements in mounting or fitting artificial teeth.

2514. John Robert Johnson, of Stanbrook Cottage, Hammersmith, and John Staines Atkinson, of Red Lion-square, for improvements in machinery for manufacturing printing types.

2515. John Bower, of Carlow, for improvements in railway sleepers.

2516. Joseph Rowell, of Aberdeen, for improvements in pillars and apparatus for straining wire.

2517. John Howie, of Hurlford, Ayrshire, N.B., for improvements in the construction of the crossings and switches of railways.

2518. Alexis Jean Moreau, of Sherborne-street, Blandford-square, for an improved mode of, or process for, reducing or melting pulverized metals or metallic ores.

2519. Henry Higgins, of Salford, for improvements in machinery or apparatus for opening, cleansing, or carding cotton and other fibrous materials.

The above bear date September 12*th.*

2521. William Harkes, of Lostock, Cheshire, for improvements in machinery for mowing and reaping.

2522. Henry James Lewis, of Birmingham, for improvements in engines to be worked by means of water.

2523. Matthew Chadwick, of Chapelfield, near Manchester, for improvements in machinery for doubling, folding, or plaiting cloth or other woven fabrics.

2524. William James Williams, of Arundel-street, Strand, for improved apparatus or machinery for punching, cutting, or pressing metal or other plates or substances; which said improvements are also applicable to tension rods.

2525. Thomas William Cowan, of the Kent Iron Works, Greenwich, for improvements in the construction of portable or fixed pumps.

2526. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for an improved mode of, and apparatus for, sleeking, creasing, and raising leather,—being a communication.

2527. Henry Bennett, of Wombridge Iron Works, Salop, for improvements in machinery or apparatus for the rolling of wire rods.

2528. William Palmer, of Sutton-street, Clerkenwell, for improvements in lamps, and in apparatus used therewith.

The above bear date September 13*th.*

2529. Edward George Chant, of London, for improvements in self-binding portfolios or holders for newspapers, music, documents, letters, and other papers, or for woven or other fabrics or articles which it

may be desired to bind or hold together.

2530. William George Rawbone, of Birmingham, for improvements in gun barrels, and in machinery to be employed in effecting the said improvements, and in tools and machinery for producing inscriptions, ornaments, and devices upon gun barrels, lock plates, and other metallic parts of small-arms, and for producing inscriptions upon saws and articles of cutlery generally.

2531. John Pender, of Manchester, for improvements in hoops for fastening bales, and in machinery or apparatus for making the same.

2532. Edward Balmforth, of Batley, Yorkshire, for improvements in machinery employed in finishing textile fabrics, commonly called raising gigs.

2533. William Littell Tizard, of Mark-lane, for improvements in the construction of ships, vessels, cupolas, and forts, and in apparatus employed therein.

2534. Henry Martin Radloff, of Limehouse, for an improvement in vessels for filtering oils.

2535. James Webster, of Birmingham, for improvements in the manufacture of nitric and nitrous acids, and other nitrogenous compounds.

The above bear date September 15th.

2537. John Whines, of Pimlico, for improved machinery for filling dipping clamps with tapers and match splints.

2538. Baldwin Fulford Weatherdon, of Kingston-upon-Thames, and Edward Henry Cradock Monckton, of Fineshade Abbey, Northamptonshire, for a new or improved engine for obtaining and applying motive power.

2539. John Golding Bunting, of Trafalgar-square, for a mechanical horse-break.

2540. George Lawrence Lee, of Holborn-hill, for improvements in the manufacture of metallic shutters for shop fronts, doors, and windows.

2541. Stephen Flexen, of Brazier's-buildings, Farringdon-street, for improvements in apparatus for ventilating railway and other carriages.

2543. Richard Moreland, junior, of Old-street, St. Luke's, for improvements in machinery for preparing and cutting hops.

2544. Robert Lakin, of Ardwick, Lancashire, for improvements in the mode of plating or shielding ships of war.

2545. Harpur Jordan, of Southampton, for improvements in rotatory engines.

2546. Charles Edward Guye, of Fleurier, Neufchatel, Switzerland, for improvements in apparatus for cutting and finishing the teeth of wheels,—being a communication.

The above bear date September 16th.

2547. Lewis Leigh, of Seymour, Connecticut, U.S.A., for improvements in certain machinery for stretching and glossing silk, wool, and other fibrous materials.

2548. Samuel C. Keeler, of New York, for improvements in veneer cutting machinery,—being a communication.

2549. Robert Cranston, of London, Edinburgh, and Glasgow, for an improved washing machine.

2550. James Simpson, of Hulme, for an improved composition for coating or covering moulded or other surfaces, and in apparatus for applying the same thereto.

2551. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in watches or time-keepers,—being a communication.

2552. William Watson and William Henry Watson, both of Harrogate, for an improved process or processes for the preparation of certain coloring matters from aniline.

2553. Joseph Douglas, of Blackfriars-road, for improvements in apparatus applicable to close fire ranges, usually termed kitcheners, for the purposes of ventilation.

2554. George Haseltine, of Fleet-street, for improvements in apparatus for the manufacture of gas from petroleum oil and water, and from cannel coals, bituminous coals, schists, tar, crude coal oil, or other hydro-carbons and water,—being a communication.

2555. John Henry Johnson, of Lin-

coln's-inn-fields, for improvements in gas burners,—being a communication.

The above bear date September 17th.

2557. Peter Halstead Whitehead, of Rawtenstall, for an improved support or stand for casks, barrels, or other similar vessels.

2558. Robert Kay, of Blue Pits, Lancashire, for certain improvements in printing calico and other surfaces, and in apparatus connected therewith.

2559. William Todd and Jacob Todd, both of Heywood, Lancashire, for improvements in machinery or apparatus for "collecting waste or fly" from spinning machinery, whether for cotton or any other fibrous material.

2560. William Herbert Browne, of Theobald's-road, and Henry Armstrong, of Manchester-street, for improvements in dry and wet gas meters.

2561. George Storey Moore, of Sunderland, for improvements in ship building.

2562. John Wymen Woodford, of Sutherland-street, Walworth, for improvements in machinery and apparatus used for driving and drawing piles, also for raising soil, and also in shoes and hoops for piles.

The above bear date September 18th.

2563. Thomas Watts, of Carisbrooke, Isle of Wight, for improvements in combined thrashing machines.

2565. William Glass, of Princes-street, Lambeth, for improvements in the treatment of sulphuret of antimony, and in obtaining products therefrom.

2566. Eugenio de La Bastida, ot Hart-street, Bloomsbury-square, for an improved cover for chimneys, adapted to prevent them from smoking, and to facilitate the extinguishing of fires therein,—being a communication.

2567. William Tytherleigh, of High-street, Marylebone, for an improved heater for ironing or pressing.

2568. John Smith and William Smith, both of Collyhurst, near Manchester, for an improved combination of machinery or apparatus for doubling, measuring, and plaiting woven fabrics.

2569. Jean Bouvet, of la Rochelle, France, for an improved mode of closing or sealing tin preserve boxes.

2570. David Clark Bridge and John Dyson, both of Halifax, Yorkshire, for improvements in the formation of boilers to be employed for warming buildings, and similar purposes.

2572. Frederick Savage, of Lynn, for improvements in traction engines.

2573. William Morshall Cochrane, of Kingston-on-Thames, for improvements in securing the bolts and nuts of railway fish plates.

2575. Robert Raynsford Jackson and John Coupe, both of Blackburn, for improvements in looms for weaving.

2576. Charles Chinnock, of Queen's-road West, Regent's-park, for improvements in the construction of cork-screws.

2577. George Maw, of Benthall Works, near Broseley, Salop, for improvements in the manufacture of tesseræ and other mosaic inlays.

2578. Edward Feis, of Sise-lane, for improvements in the construction of locks, catches, or fastenings for purses, bags, or other receptacles,—being a communication.

The above bear date September 19th.

2579. Pierre Louis Forestier, of Paris, for improvements in photographic albums.

2580. Henry Richardson Fanshawe, of Leadenhall-street, for improvements in the mode and means used in fishing in seas, rivers, and other waters.

2582. Lewis Dixey, of Brighton, and George Smith, of Angmering, Sussex, for a new or improved method of tinting by lithographic printing photographic portraits and back grounds, and embossing the same.

2583. James Wilson, of North Brixton, for an improved composition for preventing and removing incrustation in boilers.

2584. Alexander Prince, of Trafalgar-square, for improvements in steam boiler and other furnaces, and in apparatus for feeding the same,—being a communication.

The above bear date September 20th.

2585. Charles Mertens, of Gheel, Antwerp, for improvements in machinery or apparatus for scutching and dressing flax, hemp, or other fibrous materials.
2586. James Sanderson, of Clerkenwell, for improvements in writing desks and cases.
2589. William McIntyre Cranston, of King William-street, for improvements in machinery for reaping and mowing corn and other crops.
2590. Maurice Vogl, of Sambrook-court, Basinghall-street, for improvements in fastenings for leggings and other articles of wearing apparel.

The above bear date September 22nd.

2592. Robert Fairburn, of Burley, near Otley, Yorkshire, for improvements in machinery for combing wool or other fibrous substances.
2593. Thomas Knowles, James Houghton, William Knowles and William Houghton, all of Gomersal, Yorkshire, for improvements in looms for weaving.
2594. Charles Pontifex, of Saint Paul's-road, Canonbury, for improvements in means or apparatus for removing or expressing beer from yeast or from hops.
2595. William Dobson, of Nottingham, for a new method of producing various colours on lace or other fabrics.
2596. Jeanne Jara Nathalie Micas, of Chateau de By Thomery, France, for an improved railway brake.
2597. Richard Archibald Brooman, of Fleet-street, for improvements in lighting apparatus,—being a communication.
2598. Richard Archibald Brooman, of Fleet-street, for improvements in photographic apparatus,—being a communication.
2599. Séraphin Honoré Laurent, of Paris, for an improved railway brake.

The above bear date September 23rd.

2601. John Farran, of Bolton-le-Moors, for certain improvements in looms for weaving.
2603. William Taylor, of Chester, for improvements in blacking or polish.
2604. Richard Archibald Brooman, of Fleet-street, for an improved composition for painting,—being a communication.
2605. William Maddick, the younger, of Liverpool, for an improved process or method of treating and preparing madder for dyeing purposes.
2606. David Posener and Adolphe Posener, both of Rupert-street, Haymarket, for improvements in the manufacture of india-rubber and other tobacco pouches or purses.
2607. Robert Raynsford Jackson and Æmilius Irving Jackson, both of Blackburn, for improvements in the preparation and treatment of flax and other fibrous materials, to be subsequently operated upon by machinery employed for preparing and spinning cotton.
2608. Robert Raynsford Jackson and Æmilius Irving Jackson, both of Blackburn, for improvements in machinery for cutting fibrous and other materials.
2609. William Upfill and William Asbury, both of Birmingham, for improvements in the manufacture of metallic bedsteads; part of which improvements are also applicable for ornamenting tubes and curtain and cornice poles.
2610. Thomas Edwards, of Blackheath, for an improved mode of preparing fibrous materials for spinning.

The above bear date September 24th.

2613. Thomas Kennedy, of Kilmarnock, N.B., for improvements in taps or valves.
2614. Frederick Tolhausen, of Paris, for an improved steam cultivator,—being a communication.
2615. John Raywood, of Sheffield, for certain improvements in the construction of gas apparatus for the prevention of fraud, and for economising the consumption of gas.
2616. John Robert Breach and Edward Baines Pye-Smith, both of Leeds, for an improved machine for reducing or equalizing the length of animal or vegetable fibres.
2617. James Eardley, of Woodville, Leicestershire, for improvements in pitch pipes or tuning pipes.
2618. William Lea, of Wolverhamp-

ton, for improvements in hinges for French casements.

2619. Arthur Potter, of Birmingham, for improvements in electro-magnetic engines.

2620. Peter Wright, of Dudley, for improvements in the manufacture of parallel vices.

2621. John Richard Cromwell Taunton, of Birmingham, for improvements in the manufacture of metallic bedsteads, cots, and couches.

2622. Eugene Gustavus Muntz, of Birmingham, for an improvement or improvements in the manufacture of axles.

2623. Thomas Richards Harding, of Leeds, for improvements in machinery for opening, cleansing, and carding fibrous material.

The above bear date September 25th.

2624. William Pettet, of Philadelphia, for an improved covering for protecting vessels and forts from shot, shell, and other warlike missiles,—being partly a communication.

2625. John Joseph Bates, of Birmingham, for a new or improved window sash fastener and guard.

2626. Edwin Dixon, of Wolverhampton, for improvements in machinery and furnaces used in the manufacture of welded iron tubes.

2627. Charles Denton Abel, of Southampton-buildings, for a new or improved purifying and preservative lotion for the mouth,—being a communication.

2628. James Milner, Robert Dawson Milner, and Frederick Hurd, all of Wakefield, Yorkshire, for improvements in apparatus applicable to machines for preparing wool, flax, and other fibrous substances; parts of which are also applicable to machines for other uses.

2630. William Morshall Cochrane, of Kingston-on-Thames, for improvements in securing the bolts and nuts of railway fish plates.

The above bear date September 26th.

2631. Frederick Rice Stack, of Whetstone, Middlesex, for improvements in escalading apparatus for military purposes.

2632. James Crosby, of Audenshaw, near Manchester, for improvements in carding engines.

2633. Hiram Hutchinson, of Paris, for improvements in machinery for covering wire with india-rubber and gutta-percha, and similar gums and compounds thereof, and for manufacturing tubes and other articles of such gums and compounds,—being a communication.

The above bear date September 27th.

2635. Jules César Pruvost Bauchard, of Nouvion, France, for a twice-transversal kneading trough.

2636. Hugo Baum, of Elberfeld, Prussia, for improvements in the manufacture of moreens and such like fabrics.

2637. John Brown, of Middleton, Lancashire, for certain improvements in carding engines employed for carding cotton and other fibrous substances.

2638. Robert Griffiths, of Mornington-road, Regent's-park, for improvements in the construction of iron ships, and in the method of fastening metal sheathing thereon, to keep them from fouling.

2639. Michael Puddefoot, of Greenwich, for improvements in apparatus for tilling land.

2640. William Barry Lord and Frederick Hughes Gilburt, both of Sandgate, for improvements in loading fire-arms, and in blasting.

2641. William Edward Gedge, of Wellington-street, Strand, for an improved furnace for casting steel,—being a communication.

2643. Hermann Hirsch, of Bridge-road, Lambeth, for improvements in apparatus for showing combinations of colors.

2644. The Reverend Henry Moule, of Dorchester, for improvements in heating frames and the beds of hot-houses; also in heating hot-houses and other buildings used for growing plants and for other purposes.

2645. Henry Ellis, of Bangor, for improvements in the manufacture of compounds of silica, and in the application of certain compounds of silica to mineralize woven fabrics, paper, and paper pulp, to harden

and preserve stone and cement, in the production of artificial stone and paint, and in the production and glazing of porcelain and such like manufactures.

2646. Joseph Bucknall, of Boston, Lincolnshire, for improvements in the construction of horse hoes.

2647. John Addison, of St. Helier's, Jersey, for improvements in moorings or apparatus for securing articles; applicable also to the fixing of chairs for railways.

2648. Richard Archibald Brooman, of Fleet-street, for improvements in saddle-trees and collars,—being a communication.

2649. John Henry Johnson, of Lincoln's-inn-fields, for improvements in shells for war purposes,—being a communication.

2650. William Carrick and William Carrick the younger, both of Carlisle, for improvements in felting apparatus.

The above bear date September 29th.

2651. Robert Hoyle, of Newchurch, Lancashire, for improvements in machinery or apparatus for printing surfaces of woollen, mohair, cotton, and other fabrics.

2652. Eli Jean Marie Le Bréton, of Paris, for an improved propeller for boats and ships.

2653. James Leigh Hughes, of Droitwich-road, Worcestershire, for improvements in producing ornamental patterns in gold and color on porcelain, earthenware, glass, and enamel.

2655. James Wright, of Copthall-court, Throgmorton-street, for an improved rotative travelling crane, —being a communication.

The above bear date September 30th.

2657. Peter Gerhard Vander Byl, of Upper Hyde Park-gardens, for a power conserver brake, for utilizing the power expended in stopping or retarding machinery, locomotive or other engines, and vehicles of any description when in motion,—being a communication.

2658. Robert William Greenwood and Charles John Marson, both of Gloster-crescent, Islington, for a new and improved mode of using the exhaust steam of steam engines, by re-conveying the same into the boiler.

2659. Bryan Donkin, of Bermondsey, for improvements in bearings for shafts, axles, pivots, and sliding surfaces, for the purpose of diminishing friction,—being a communication.

2661. William Colborne Cambridge, of Bristol, for improved apparatus for washing clothes; applicable also as a churn.

The above bear date October 1st.

2662. James Gilchrist, of Glasgow, for improvements in boring engines, such as are used for mining purposes.

2664. William Crane Wilkins, of Long-acre, for improvements in gas burners.

2665. Edmund Suckow and Edward Habel, both of Manchester, for improvements in machinery for preparing, spinning, and doubling fibrous materials.

2666. John Henry Johnson, of Lincoln's-inn-fields, for improvements in the permanent way of railways,—being a communication.

2667. George Jordan Firmin, of Millwall, for improvements in the treatment of certain salts of potash and lime.

The above bear date October 2nd.

2668. Francis Ensor, of West Bromwich, and William Payne, of Birmingham, for a new or improved apparatus for regulating the pressure of steam in steam boilers, and for indicating when the water in steam boilers is too high or too low.

2669. John Harrop, of Manchester, and James Wadsworth, of Salford, for improvements in deodorizing refuse organic, fecal, and urinous matters, and in a method of utilizing coal and other ashes, and in machinery or apparatus connected therewith, for producing a portable manure therefrom.

2670. Thomas John Robotham, of Burslem, and Edward Oswald, of Stoke-upon-Trent, for improvements in apparatus for purifying "glaze," "slip," or other potters' materials.

2671. Richard Broadbent, of Leeds, for improvements in gas regulators.

2673. William Clark, of Chancery-lane, for an improved candlestick,—being a communication.

2674. William Edward Gedge, of Wellington-street, Strand, for an improved suction and lift pump, and apparatus connected therewith,—being a communication.

2675. Alexander Dalrymple, of Sheffield, for improvements in the processes of depositing metals by galvanic action, either with or without the aid of galvanic batteries, and in the ornamentation of metal surfaces thereby.

2676. William Edward Gedge, of Wellington-street, Strand, for an improved marquetry or veneer saw, and machinery or apparatus connected therewith,—being a communication.

2677. Thomas Greenwood, of Leeds, for improved machinery for cutting staves.

The above bear date October 3rd.

2678. Joseph Lee and William Lee, both of Leicester, for improvements in traction engines, and boilers for traction, locomotive, and other purposes.

2679. William Henry Muntz, of Millbrook, Hants, for improvements in armour for the protection of ships of war, and other vessels and fortifications, from the effects of cannon shot and other projectiles.

2680. Andrew Barclay, of Kilmarnock, N.B., for improvements in printing textile materials and fabrics, and in machinery therefor.

2681. William Edward Gedge, of Wellington-street, Strand, for improved means or apparatus by the use of which pierced or perforated cocoons may be spun,—being a communication.

2682. Samuel Amphlet, of Birmingham, for an improvement or improvements in ornamenting surfaces of wood.

2683. Jonathan Edwin Billups, of Cardiff, for fixed points for railways.

2685. Frederick Parkinson, of Wood-street, for improvements in ladies' shawls and cloaks.

2686. Francis Watkins, of Smethwick, for improvements in apparatus for milking cows.

2687. Frederick Ernest Blatspiel, of Warwick-court, for improvements in diving apparatus, and apparatus to be used for working in deep water,—being a communication.

2690. Frederick Johnson, of Portsmouth, for improvements in domestic fire escapes, and in receptacles for the same.

2691. William Taylor and Samuel Buckley, both of Oldham, for improvements in machinery for preparing cotton and other fibrous materials.

The above bear date October 4th.

2692. Robert Page, of Great Yarmouth, for improvements in stables and stabling; applicable in part to kennels and to the floors of fish houses.—[*Dated October 6th.*]

New Patents Sealed.

767. R. A. Brooman.
768. R. A. Brooman.
769. R. A. Brooman.
770. R. A. Brooman.
775. Albert Hill.
777. Edwin Smith.
778. Edward Field.
783. Robert Kay.
785. James Newall.
786. J. M. Hart and R. Lavender.
787. James Fawcett.
788. James Humphreys.
789. B. H. Mathew.
793. David Abercrombie.
795. Toni Fontenay.
798. John Davis.
801. J. H. Tuck.
802. J. G. Jennings.
805. William Holliday.
806. G. Hartshorne, jun., D. G. Ward, and W. Woolley.
808. J. H. Brierley.
813. Benjamin Fleet.
814. John Topham.
816. William Henson.
817. John Stewart.

821. W. Beaumont and J. W. Edge.
822. Alfred Fryer.
824. Theophile Guibal.
828. William Clissold.
830. Leo de la Peyrouse.
833. James Parker.
835. Henry Nunn.
847. Frederick Tolhausen.
848. Richard Edwards.
852. Comtesse de Vernede de Corneillan.
854. Robert De Bary.
860. G. H. Birkbeck.
864. W. B. Nation.
865. R. A. Owen.
869. Edmund Smith.
872. John Boucher.
873. Youngs Parfrey.
875. Israel Morris.
880. William Paterson.
883. E. B. Hart.
884. J. Platt and W. Richardson.
889. Robert Young.
891. William Tyler.
892. W. H. Hook.
894. W. B. Lord and F. H. Gilbart.
897. R. C. Ransome.
899. L. B. Schmolle.
901. J. M. Clements.
906. P. R. Couchoud.
907. C. P. Gontard.
908. William Clark.
911. William Turner.
917. E. Hartley, G. Little, and J. Hinchcliffe.
919. H. J. Madge.
920. J. Platt and W. Richardson.
923. George Holcroft.
924. The Rev. George Scratton.
925. Samuel Warren.
930. Bewicke Blackburn.
931. Samuel Hunter.
932. Thomas Moore.
935. William Leopard.
937. Gustave Rebour.
938. William Helme.
939. Robert Morton.
940. G. Bower and J. Qualter.
942. George Hunter.
943. R. M. Toogood and J. Laybourne.
944. W. Kemp and T. Cowley.
946. D. Wilson and E. A. Cowper.
948. Alexander Mann.
949. W. A. Richards.
950. H. T. Hassall and M. Burke.
951. J. F. Woodall.
952. J. C. Kay and W. Hartley.
955. F. C. Bakewell.
956. Thomas Silver.
959. George Moulton.
963. S. Fielding, S. Fielding, junior, R. Fielding, and T. Fielding.
964. R. A. Brooman.
966. W. E. Newton.
972. William Begg.
974. John Colling.
975. Alexander Clark.
976. Leopold Faconnet.
977. R. A. Kobitzsch.
979. Benjamin Thompson.
980. C. S. Duncan.
982. William Simons.
983. Alfred Harris.
984. Edward Welch.
985. George Haseltine.
987. Thomas Jackson.
988. J. Watremez and A. Kloth.
991. James Brown.
997. F. W. Brearey.
998. E. H. C. Monckton.
999. John Jaques, junior.
1000. Benjamin Sharpe.
1004. James Wright.
1005. T. Cobley and J. Wright.
1007. J. E. H. Andrews.
1008. Squire Farron.
1009. George Hollinshed.
1010. James and John Bullough.
1011. William Taylor.
1013. Josiah Jones, junior.
1014. John Langston.
1016. John Knowelden.
1019. Robert Theyson.
1023. William Nunn.
1024. John Houghton.
1027. C. P. Coles.
1029. L. Christoph, W. Hawksworth, and G. P. Harding.
1030. Henry Deacon.
1031. J. Platt, W. Richardson, and W. Holland.
1032. John Petrie, jun.
1033. George Burge.
1034. C. Bartholomew and J. Heptinstall.
1037. William Fox.
1039. Henry Holland.
1043. W. E. Gedge.
1045. François Rigollot.
1048. Ellis Butterworth.
1049. William Clark.
1051. J. H. Johnson.
1052. J. Howard, E. T. Bousfield, and T. Phillips.
1053. Isaac Whitesmith.
1054. Joseph Bunnett.
1055. Nicholas Nussey.
1058. Edgar Drewett.
1061. James Park.
1062. Edward Peyton.
1063. J. F. Spencer.
1065. Frederick Tolhausen.
1069. J. K. Hampshire.
1071. Charles Harratt.
1074. R. A. Brooman.
1075. R. A. Brooman.
1076. R. A. Brooman.
1080. T. H. Bennett.
1081. F. A. Le Mat and C. F. Girard.
1085. George Bedson.

1086. J. Platt and W. Cheetham.
1087. J. Platt and W. Richardson.
1088. R. A. Peacock.
1090. T. W. Gray.
1091. F. C. Phillipson.
1096. T. Edwards and J. Harrison.
1097. John Barbour.
1098. W. F. Lock.
1100. David Stott.
1104. F. P. Warren.
1110. J. H. Johnson.
1111. John Ashbury.
1120. William Harling, J. W. Todd, and T. Harling.
1122. James Murphy, senior.
1125. J. L. Perin.
1127. C. D. Abel.
1128. R. A. Brooman.
1129. R. A. Brooman.
1132. S. Rideal and R. Shepherd.
1133. William Clark.
1134. J. C. Rivett and J. M. Hetherington
1135. Ralph Wedgwood.
1136. Robert Dennison.
1138. J. S. Phillips.
1141. R. and G. Stuart and H. Hill.
1142. Benjamin Rhodes.
1145. Edward Loysel.
1146. William Rose.
1147. Alexander Parkes.
1148. A. N. Wornum.
1149. Alexander Parkes.
1150. Henry Lumley.
1151. A. P. Tronchon.
1153. E. H. C. Monckton.
1155. S. P. Matthews.
1159. R. A. Brooman.
1161. Thomas Attwood.
1165. C. C. Creeke.
1166. T. Lea and S. Smith.
1167. E. H. C. Monckton.
1168. S. S. Putnam.
1171. Arthur Warner.
1174. Robert Boby.
1177. William Moir.
1178. G. N. Bates.
1179. G. H. Birkbeck.
1180. William Carpenter.
1184. Alfred Hodgkinson.
1186. G. T. Bousfield.
1188. W. E. Newton.
1191. John Endean.
1192. William Haggett.
1193. Henry Wheatley.
1194. John Bond.
1196. John Winsborrow.
1197. George Davies.
1201. Frederick Dangerfield.
1202. Robert Mushet.
1204. Rudolph Zimara.
1208. George Richards.
1215. John Shaw.
1218. A. C. Kirk.
1223. E. A. L. Negretti & J. W. Zambra.
1224. W. E. Newton.
1228. J. G. N. Alleyne.
1230. William Clark.
1233. A. Boyle and T. Warwick.
1235. Gustav Bischof, junior.
1244. W. T. Glidden.
1262. W. E. Newton.
1263. Michael Henry.
1268. George Davies.
1275. James Oxley.
1285. W. E. Newton.
1294. T. F. Griffiths.
1295. Robert Walker.
1319. Salvatore Merolla.
1320. W. E. Newton.
1324. P. V. Lefebvre.
1329. Thomas Wilson.
1333. François Marrel.
1361. Thomas Markland.
1364. Nicholas Wood.
1490. Nathan Ames.
1506. F. E. Sickels.
1529. H. B. Barlow.
1601. J. F. Harrison.
1612. P. Boisset and B. Antognini.
1646. Joseph Betteley.
1663. Joseph Whitworth.
1668. J. J. H. Gebhardt.
1731. John Alison.
1757. Abram Longbottom.
1767. James Lancelott.
1795. George Haseltine.
1833. John Anderton.
1839. G. T. Bousfield.
1844. Henry Ponsonby.
1857. E. C. Nicholson.
1874. George Peterson.
1877. J. B. Coquatrix.
1900. Charles Callebaut.
1912. W. Easton and G. Donkin.
1967. O. W. Child.
1990. Elmer Townsend.
2007. Thomas Hill.
2052. O. F. Morrill.
2067. William Tranter.
2075. William Clark.
2097. William Clark.
2104. Henry Rawson.
2161. Horatio White.
2162. William Wanklyn.
2189. James Briggs.
2230. George Haseltine.
2256. C. A. Wheeler.
2267. John Cooper.

*** *For the full titles of these Patents the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.*

NEWTON'S

London Journal of Arts and Sciences.

No. XCVI. (NEW SERIES), December 1st, 1862.

THE CULTIVATION OF TOBACCO—IRELAND'S WEALTH.

If it be not generally known that the people of Great Britain and Ireland possess, beyond any other people in the world, the advantages of liberty, justice, and consistent honesty of purpose in their rulers, it is not because the matter has been kept secret; for our books, our newspapers, our orators, our very hand-bills, all teem with information to the above effect; and even a foreigner coming amongst us cannot prudently overlook the fact, though he may have, perhaps, but a very hazy idea of its nature. The thing, indeed, is a popular weakness, and as such is dexterously handled by unprincipled persons.

But let us for a moment imagine a man determined to tell the plain truth, and enforce his argument by undeniable references to established facts and authorities, and what kind of reception will he meet with? I ask this question with some degree of anxiety, for I am about to make the experiment myself; that is to say, I am about to show that the exchequer of this model nation receives about five millions sterling per annum, as a bribe or placebo in support of that very slave trade which the nation affects to condemn; moreover, that the industrial development of this empire is crippled for the express purpose of encouraging the importation of slave-grown produce; and, lastly, I will prove that this pernicious practice, which had its origin in the difficulties created during the civil wars of Charles I., has been continued down to the present time, in direct defiance of every principle, not only of humanity but of that liberty, justice, and consistent honesty of purpose to which the nation arrogantly lays claim. It forms no part of my present purpose to expose the absurdity of these pretensions: my object is altogether different, and is limited to the illustration of the evil consequences resulting from the prohibition of the growth of tobacco in these islands, and more especially in the south of Ireland.

In the first place, I propose to show that tobacco was originally grown in this country for the use of the inhabitants; secondly, that a duty was levied upon its importation from abroad, and the whole trade monopolized by Charles I., whose impolitic conduct led to the establishment of the Commonwealth, and the prohibition of the growth of tobacco, in order

more easily to collect the duty upon it.* I shall next solicit attention to the fact that the money thus squeezed, at second-hand, from the toil and torture of negro slavery, amounts to something like five millions sterling per annum. I will then demonstrate that tobacco has been, and can be, well and profitably cultivated in this country and in Ireland; moreover, I will show that its cultivation in Ireland, as a rotation crop for the potato, is exactly the remedy required to exterminate the peculiar disease to which that esculent is liable. And, lastly, having in mind the fact that, for a long series of years, duties have been collected upon hops and malt, I will ask, what unusual difficulty could arise in collecting a duty upon home-grown tobacco. In conclusion, I will add a few remarks upon the use of tobacco and other sedatives in regard to their sanitary bearing, for although I make no use of tobacco in any shape, yet, as a medical man, I am well acquainted with its therapeutic qualities.

At pages 465 and 466 of Dr. Thomson's London Dispensatory for the year 1833, will be found a considerable amount of interesting information upon the subject of tobacco, from which it appears that this plant "was first cultivated in England in 1570," and, moreover, that "tobacco was, at one period, raised to a considerable extent in Yorkshire, but the cultivation of it for the purposes of trade has been long prohibited."

Again, with respect to its home growth, and particularly in Ireland, I refer my readers to Dr. M'Culloch's Dictionary of Commerce for the year 1834, pages 1161 and 1162. After describing the first introduction of smoking by Raleigh, and alluding to the futile attempts of James I. to restrain the custom, M'Culloch thus continues, "During the early part of the reign of Charles I., the trade in tobacco was monopolized by the Crown. The monopoly was not, however, of long continuance, and totally ceased at the breaking out of the Civil War. Tobacco plants had been early introduced into England, and were found to answer remarkably well. Their cultivation was, indeed, prohibited by James, and afterwards by Charles, but apparently without effect. At length, however, the growing consumption of tobacco having excited the attention of the Government financiers, it was seen that, by imposing a duty on its importation, a considerable revenue might be raised; but that, were it allowed to be freely cultivated at

* Prohibitions had, indeed, been issued before this, but they were rather to annihilate the use of tobacco than to prevent its growth, consequently they failed to produce any effect; and although, it is worthy of remark, that the very necessities, which still press so very unfairly and inconsistently upon the industry of the country, had their rise in civil warfare, yet the principal point here is to notice that the excuse for the prohibition had no higher motive than to facilitate the collection of money, and this excuse is all that can be advanced in favour of the enactment at the present day.

home, it would be very difficult to collect a duty upon it. In 1643, the Lords and Commons imposed a moderate duty for the sake of revenue on plantation tobacco; but instead of directly prohibiting the use of native tobacco, they burdened it with such a duty as it was supposed would occasion its culture to be abandoned. The facility, however, with which the duty was evaded, soon satisfied the republican leaders that more vigourous measures were required to stop its cultivation, and consequently to render its importation a source of revenue. Hence, in 1652, an Act was passed prohibiting the growth of tobacco in England, and appointing commissioners to see its provisions carried into effect. This Act was confirmed by Charles II." * * * "This Act did not, however, extend to Ireland, and, of late years, the cultivation of tobacco made considerable progress in that country. Had this been allowed to continue, there can be no question that, in a few years, the revenue, amounting to about three millions a year, would have been materially diminished, for it would be quite visionary to suppose that any plan could have been devised for collecting a duty even of £100 per cent. upon tobacco, supposing it to have been generally cultivated in Ireland. No one, therefore, can question the wisdom of the late Act, prohibiting its growth in that country, and of rigourously enforcing its provisions. Any advantage Ireland might have gained by its cultivation would have been but a poor compensation for the sacrifice of revenue it must have occasioned."

This quotation speaks for itself, and as it is from the pen of an admirer of prohibitive industry, may be fairly supposed to have given us the best points on that side of the argument. It conclusively proves that tobacco of good quality can be grown in Ireland, otherwise no prohibition would have been needed; and when I have shown, as I shall do, not only that the finest kinds of tobacco have been grown there, but that, by this very process, the soil is cleared of its superabundant constituents, so as to enable it to grow potatoes free from disease, I believe I shall be able to present a far more reliable estimate of what Dr. M'Culloch calls "a poor compensation" than that prohibitive advocate; even though he had not himself furnished both facts and arguments showing the fallacy of the system he eulogises. For instance, in speaking of the Navigation Laws, and their effect upon the commerce of the Dutch, he says:—"Excessive taxation, and not our navigation law, was the principal cause of the fall of profits and of the decline of manufactures, commerce, and navigation in Holland." He then gives a long quotation from the author of the "*Commerce de la Hollande*," showing the injurious action of taxes, which increase the value of labour in any country, and render it unequal and unable to compete commercially with others; and this he terminates by telling

us that it is to "the excess of taxation that the decline of the commercial greatness and maritime power of Holland was really owing"—as if a tax of five millions sterling upon an article principally used by our labouring classes would have no such effect in England!

But, to waste no more words upon theoretical arguments, I will refer to positive knowledge, either verified or discovered by myself, and for the accuracy of which I have, therefore, no hesitation in accepting a full responsibility. This positive knowledge embraces the actual growth of tobacco in various parts of the south of Ireland—from Dublin, on the east, to Cork, on the south, and round to Galway, on the west; also, the expressed opinion of tobacco merchants in London and Liverpool, with respect to the value and quality of the tobacco crop; also, an analysis of the ash or saline and earthy matters taken from the soil by this tobacco; also, a report of the quality of potatoes grown upon the same soil as the tobacco, both before and after the tobacco crops; also, an analysis of the ash of the potatoes and the ash of the potato plant, so as to show exactly what is removed by the tobacco from the soil, what by the potato, and what is removed but again returned by the potato plant, so as to regurgitate, as it were, upon the vegetation power of the soil, and create in the potato a disease of the kind brought on in animals by over-feeding: for the potato plant is not taken from the ground, but suffered to decay upon it; and thus continually casts back the saline and earthy constituents, the accumulation of which brings on that unhealthy stimulus in the potato, ending in disease, to which the term over-feeding may be very correctly applied.

Now, what I wish particularly to point out here, is the fact, that the tobacco plant and the potato plant remove from the soil almost exactly the same substances, so that the very ashes, which from the potato plant accumulate in the soil, to the disadvantage of the potato or tuber, would be taken up and carried away in the succeeding crop of tobacco. Therefore we have, by the cultivation of tobacco in Ireland, all the advantages of an economical and practical system of rotative cropping. I must, moreover, call attention to the fact that the cultivation of tobacco gives employment to an immense amount of what is called "unskilled labour," or, in other words, that it would furnish work for a very large number of children and women during almost the whole of the year. To prove all this, I ask the reader to accompany me through the following details; merely premising that the experiments, to which I am about to allude, have been made systematically and regularly during the last ten years, and are chiefly indebted for their value to the generosity, perseverance, and talent of a small number of gentlemen, without whom it would have been impossible for me to carry out the

agricultural portion of this inquiry. The fact that such experiments are prohibited, and therefore illegal, alone prevents me from awarding "honour where honour is due"—but a brighter day may come.

In the year 1851, three patches of ground were tilled, and planted with potatoes in the usual manner; one of these was a little to the south of Dublin, another to the north-east of Cork, and a third between Limerick and Ennis. From all these, the potatoes produced were more or less diseased, and many of the larger ones were hollow. I made analyses of these different potatoes, and also of the potato plants, taken from the soil at the period of seeding, or, in other words, when they afforded "potato apples" (and here let me step aside to say, that altogether I have made 277 separate and distinct analyses in this inquiry). During the following winter, the same patches were tilled, and prepared for the growth of tobacco. The seed was sown in the latter part of the month of March, upon a small part of the ground, and when the plants had grown sufficiently, they were transplanted, and placed upon the other part of the ground, at a distance of about a yard from each other, the interspace being trenched or dug up in both directions, so that each plant stood upon a little square pyramid of its own: this was done in the beginning of June. The plants grew well, but required much attention in watering, and removing from them any decaying leaves or insects; and it was found necessary, at times, to trench up the soil, and favour the circulation of air through the plants; the whole of which work, as well as the transplantation, was performed by women and young boys and girls. Towards the middle of July the plants were "topped," at the height of about a yard; that is to say, the top of the plant was cut off at this height, so as to throw the whole energy of the plant into the leaves, of which from eight to fourteen were left upon each plant, the two lowest leaves being removed at the same time. Towards the end of August, it was seen that several of the leaves were turning yellow, and these were therefore removed, until about the middle of September, when the plants were pulled up, and all the leaves picked off, and added to those previously collected. They were allowed to dry under cover, in an open shed, being repeatedly turned over and spread about, so as to prevent heating, and facilitate the process of drying. This process was continued for a week, after which they were removed to a temporarily constructed oven, something like a hop-kiln, in which they were kept for three days, at a very gentle heat. After this, they were packed away in boxes of about a yard square, from which, however, they were turned out and sorted every week, so as to get rid of any decaying leaves, calculated to injure the flavour of the tobacco—an operation which it was found necessary to continue during the whole of the succeeding autumn.

In February, 1853, samples of this tobacco were shown to proper persons in London and Liverpool, who declared it to be excellent, and as fit for the manufacture of snuff as the "best Virginia;" in which a Dutch merchant also agreed, by emphatically expressing his opinion, that "it would be a sin to waste it in smoke." Anxious not to weary my readers, I will merely say, that I made analyses of the tobacco plants in question, taken towards the end of August, and that these experiments and analyses have been carried out, not only with regard to the three localities mentioned, but also as regards fifteen other places in the south of Ireland, from all of which, results have been obtained of a most uniform and satisfactory character, which results I will condense into a short table, after I have sufficiently secured the attention of my readers to the following fact.

The patches of ground from whence the tobacco had been taken, were next tilled and planted with potatoes, of the very same kind as those which had previously given a diseased product. Now, mark the result! The plants were smaller, greener, and without black spots on the leaves; the tubers or potatoes were smaller, denser, of a higher specific gravity, and free from disease and hollow centres: moreover, the same effects have followed upon the same treatment in other parts of Ireland, and also in Wales. Of course, the extermination of the disease may be referred to other causes than the direct influence of the tobacco crop: the preparation, or, I might say, the subdivision of the soil, the care in destroying the grubs or insects, the periodical irrigation, the cleansing, and the removal of the dead roots of the plants, are all more or less favourable to the succeeding potato crop; but I think no impartial person can run his eye down the following table of analytical results, without being struck with the fact, that the tobacco plant removes or absorbs from the soil exactly the very same things which the potato plant casts back into it, so as to produce, after a time, a superabundance of those agents which in moderate quantity give a healthy stimulus to the soil, but when in excess create unnatural and diseased vegetable products. Of the tuber or potato I have little to say, although I have analysed the ashes from every variety; in fact, there is so small a quantity of ash in this esculent, that it seems to take almost nothing from the soil; it is a purely atmospheric production; and, if the inhabitants of Ireland are volatile, changeable, and turbulent, they only agree with the peculiarities of the aerial magazine from whence they derive the staple article of their food.

But now for the analyses. Of the potato plant covered with seed or apples, but free from tubers, 112 lbs. were dried in the sun and air for three days, after which they were placed in a shallow vessel, and subjected to a temperature of 212° Fahrenheit until they ceased to lose

weight; they then weighed 19 lbs. 4 oz., which is at the rate of 17·18 per cent. The dried plant was then thoroughly incinerated in a muffle, at a low red heat, until it became quite white; it then weighed 12¼ oz., which upon the dried plant is at the rate of nearly 4 per cent. In precisely the same manner 112 lbs. of the tobacco plant were treated—not the leaves only, but the whole plant, taken up at the end of August. This gave 27 lbs. of dried product, or at the rate of 24·1 per cent. These 27 lbs., after incineration, yielded 5¼ lbs. of ashes, or at the astonishing rate of nearly 20 per cent. No sensible difference has been found, although the above experiments have been repeated more than fifty times during the last ten years, and, therefore, I consider the results worthy of the greatest confidence, as regards Ireland. The composition of the ashes was as under, and I have added to these the composition of the ashes from a sample of flax, grown in the county of Armagh, and which afforded 5 per cent. of ashes:—

	Potato Plant.	Tobacco Plant.	Flax, by Sir R. Kane.
Potash	5·5	8·7	6·332
Soda	2·8	1·2	6·350
Lime	28·2	32·2	22·699
Magnesia	·7	2·8	4·053
Alumina	1·1	1·6	—
Oxide of Iron	·6	·7	13·520
Do. Manganese	·2	—	1·092
Sulphuric Acid	2·3	4·1	8·929
Phosphoric Acid	3·4	6·1	7·002
Carbonic Acid	22·7	27·5	4·107
Chloride of Sodium	2·1	3·8	·904
Silica	30·2	11·2	24·978
Loss	·2	·1	·034
	100·	100·	100·

The reason why I have quoted Sir R. Kane's analysis of the ashes of flax is, because Lord John Manners lately pointed out, at a Farmers' Club meeting, the adaptibility of Ireland for the growth of flax, as a substitute for the slave-grown cotton of America. The project has evidently something solid in it, for, with the exception of the oxide of iron, there is a marked similarity in the matters, which are, as I may say, congested into the soil by the potato plant, and absorbed and carried from it by the flax. Thus far, then, I hail his Lordship's project with approval, and shall be glad to see it practically tried, as an antidote to both the potato disease and cotton famine. Still, however, the superiority of the tobacco plant is no less clear and patent in regard to the ashes, than in respect to the vast amount of unskilled labour which it will call into use in the very country where such labour is superabundant.

I will not allow the attention of my readers to be distracted by any

great quantity of arguments in opposition to the palpably false objection, that "a tax could not be collected upon tobacco grown in Ireland;" I have before said, the collection of the hop tax, so recently abandoned, is alone a sufficient answer. But there is something still more decisive—still more demonstrative. In France, tobacco is grown to the value of nearly a third of a million sterling, thus giving constant employment to 7000 workmen, and (mark the words!) returning annually to the exchequer of the empire nearly 3½ millions sterling! This relates to the year 1854, but at the present time the return is approaching five millions; however, I am content to quote the fact as it stands recorded in the fourth volume of the "*Traité de Chimie Generale*," by Messrs. Pelouze and Fremy; at page 418 of this volume, the following passage may be found:—"Le tabac constitue, pour six départements de la France, un produit de 10 millions de kilogrammes, valant 8 millions de francs; sa fabrication occupe sept mille ouvriers, et rapporte à l'Etat 86 millions."

I do not think it necessary, nor even advisable, to add anything more to the facts here developed; for the subject will, in all probability, be brought before the House of Commons in a few weeks, when the history of this glaring instance of political mismanagement must resolve itself into a question, at once ridiculous and lamentable. The so-called "Liberal Government" will be asked "to place the people of Great Britain and Ireland on a level with the slave-owners and negroes of the Southern States of America," in fact, to unfetter our hands, and set the industry and capital of the country at liberty, that they may fairly compete with, and combat, slavery. Of course there will be a violent opposition from the excise drones of society—the creatures who live upon the imperfections of humanity, as fungi grow upon rotten wood. It will, no doubt, be pointed out that, according to my own showing, the tobacco plant takes up five times as much earthy and saline matter as is given off by the potato plant—and this is true; but it is also true, that the tobacco plant occupies five or six times the space required for the cultivation of the potato plant; so that the equilibrium is not disturbed as regards the ashes. Again, it will be contended that the potato disease is not confined to Ireland; as if supersaturation of soil by stimulants might not and does not occur in other countries, and as if the effects of lime and ashes in the soil upon the potato disease, had not been fully and practically examined by one of the best chemists in France (M. Boussingault). For all this, and much more, there will be no difficulty in providing a sufficient answer; but even if it were otherwise, what has this to do with the merits of the question at issue? That question stands as before—"Are the white slaves of Great Britain and Ireland not to be put upon an equal footing with the black slaves

of Virginia, because it would give the Chancellor of the Exchequer a little extra trouble to collect the revenue?"

This is the culminating point at which the inquiry ends, and now I will say a few words about the sanitary nature of tobacco. When we examine into the recorded characteristics of the human race, we find that, in proportion as these characteristics rose above the instincts of mere animals, so a desire manifested itself for a means of diverting the mind, and turning it away from the painful realities of life, to the fantastic enjoyments of imagination. This end can be attained by various means; but whatever the means, the end is still the same, and must be regarded as an indispensable adjunct to civilisation. Music, dancing, poetry, wine, alcohol, opium, tobacco, even religion, are all agents which blunt the sharp edge of worldly care, and realise the motto, "*Non semper arcum tendit Apollo.*" Many of these produce their calming or sedative effect by acting, in the first instance, as stimulants, consequently they are liable to great abuse, and require at all times to be employed with discretion; with this class I have now nothing to do, because the only sedative in question—that is to say, tobacco—has no such defect; it is altogether and entirely a direct sedative—it has no stimulating qualities whatever. It calms, it soothes the human mind, and creates a kind of mental cloud, upon which the bright sun of imagination reflects the most gorgeous tints. It carries within itself the elements of its own happiness, and seeks for no company, no assistance from without. Need we wonder, then, that the use of such a sedative has spread like oil over the troubled surface of civilization? No. But we may wonder that so cheap and unobjectionable a solace has been made into a vehicle for exorbitant taxation. Still more we may wonder, why the industrial energy of this great nation permits itself to be chained hand and foot, that slavery may flourish, and facilitate fiscal rapacity.

Therapeutically considered, the moderate use of tobacco is harmless in most cases, useful in many, and injurious in but a few exceptional instances.

LEWIS THOMPSON, M.R.C.S., &c.

GRINDING AND POLISHING TOOLS.

WHATEVER may be the disadvantages attendant on Exhibitions such as that which, for the last six months, has daily attracted tens of thousands of admiring visitors to South Kensington (and that weighty objections may be urged against such Exhibitions we readily allow), the opportunities they afford for introducing useful novelties to the attention of the seeker after improvements, must be acknowledged

as no small recompense to manufacturers for the cost and trouble of preparing their contributions. The novelties which, through their adoption, are destined to afford the largest recompense to exhibiting manufacturers, are, perhaps, raw materials, which may serve to initiate new branches of manufacture, or improved manufactured materials, such as iron, steel, alloys, &c., which, by their increased strength or non-oxidisable qualities, may furnish the engineer or the manufacturing chemist with new powers; but new tools, of whatever kind, by effecting an economy in the working out of some purely mechanical operation, may have an amount of utility which it would be difficult to overrate. Of the many examples of new tools which the International Exhibition contained, there was not one, perhaps, of less pretentious appearance than the emery wheel of Messrs. Warne and Co.; yet, we may safely affirm that, in all that large display, not one is capable of wider application, if the merits of the wheel—as they declared themselves to us, under severe experimental working—should, as we doubt not they will, be confirmed by continuous use. Emery wheels, of some sort, have, as is well known, been employed for many years past, in Sheffield and elsewhere, for polishing steel, but their application was limited; as the binding material being glue and treacle, the contact of water or oil would destroy these wheels.

In December, 1858, Mr. F. Ransome patented the combining of ground glass and emery with a soluble silicate, for the manufacture of grinding and rubbing surfaces; but the invention has hitherto found little favour in our workshops. We are indebted, also, to America for the manufacture of emery wheels and polishing sticks; the emery being kneaded into plastic vulcanised india-rubber or gutta-percha, which was afterwards moulded into the required form, and hardened by heat.* These tools, although extensively used, as we believe, in the workshops of the western world, are little known in this country. The objection which has been raised to them is, that the vulcanite or binding material for the grit, being a tough, horny substance, instead of breaking away with the displaced grains of emery under the friction to which the wheel is exposed, softens under the heat, and forms a kind of glaze on the grinding surface; thereby destroying, or greatly deteriorating, its efficiency, which can only be restored by the application of a red-hot iron to the glazed surface.

To remedy this defect, Messrs. Warne and Co., or rather the acting partners of the firm, Messrs. Coles, Jaques, and Fanshawe, after a series of experiments at their factory, the Tottenham India-rubber Works, succeeded in applying a comparatively new material, lately introduced by Mr. Frederick Walton, as a substitute for india-rubber, to the manufacture of emery wheels; and this application they patented in August last.

Before referring to the nature of the experiments carried out at the Exhibition building, by emery wheels of this new manufacture, it will be well to say a few words respecting the cementing material employed in making the wheels. This is protected as a plastic substance, under a patent obtained by Mr. Walton, in January, 1860, and subsequently, in the form of a varnish, under a patent granted to Messrs. Walton and Beard, in September, 1861. It consists of solidified linseed oil,

* Newton's patent, dated June 15th, 1859.

brought to that state by oxidation or exposure to the air, and tempered to its special uses by the introduction of shellac or other like gum. The merits of this compound, as stated by Mr. Walton, in a paper read by him before the Society of Arts, in April last, are—"that being unaffected by oil or grease, it is more durable than rubber in many of its applications; that when rubber is injured by temperature, this is unaffected; and, lastly, it is free from those elements of decomposition which are set in action by the very process that it is necessary for the rubber to undergo in course of manufacture."

This material, it would appear, when mixed with emery or other grit, is capable of being moulded to any required shape, and hardened precisely like vulcanized india-rubber. Messrs. Warne and Co., in carrying out their invention, manufacture their wheels of any given size, mount them on a horizontal spindle, and drive them at a great surface speed. The form of the periphery is made to suit the work in hand. Thus, not only may plain surfaces be ground, but also bevilled and curved surfaces, and mouldings of various patterns. When using the wheels for grinding glass, slate, or marble, water is applied; but when grinding or cutting metals, neither water nor oil are employed. Instead, also, of using emery, chilled iron filings and granulated cast iron are sometimes employed as a substitute therefor. The emery wheels are, however, to be preferred, as they are equally applicable to the grinding of glass as of metals, whereas the granulated iron wheels are applicable only to metals. Moreover, these latter wheels will not admit of being driven at so great a velocity as the emery wheels, by reason of their liability to heat; although, therefore, an effective speed for the acting surfaces of the emery wheels is 4000 feet per minute, the speed of the granulated iron wheels should not greatly exceed 2000 feet per minute.

When invited to witness the capabilities of the improved emery wheel, we applied to the flat grinding surface (when the wheel was in rapid motion) a 16-inch file, and in a few seconds the teeth were ground out, and a polished surface produced, without any visible deterioration of the grinding surface. As a further test of its durability, we applied the edge of the file to the edge of the rotating tool, and formed therein a series of notches, but again without any material deterioration of the cutting edge, and without sensibly increasing the temperature of the grinding surface. The utility of grinding tools that will stand such severe tests will be readily appreciated by mechanical engineers, when it is known that their selling price is but 1*s*. per pound, and that the wheels may be worked down almost to the spindle. The reason given by the manufacturers for these wheels not clogging, like the india-rubber or gutta-percha wheels, is, that the cementing substance being more brittle than the elastic gum, breaks away with the emery during the grinding action, and thus exposes a fresh and efficient grinding surface.

Besides this useful addition to the workshop, the manufacturers promise shortly to introduce a soft wheel, as a substitute for the leather buffing wheel now in use at Sheffield, for polishing cutlery. It will be a modification of the grinding wheel, and will admit of being used either dry, or with oil or water. The operation of the polisher we have not, however, had an opportunity of witnessing. When applying grinding and polishing tools to glass or marble, they may be used as horizontal discs or slabs, having either a reciprocating or a planetary motion.

Recent Patents.

To William John Bennett, *of Millbank-street, Westminster, for an improved solution or preparation to be used with Portland and other cements, for the production af artificial stone, or for building purposes.* —[Dated 10th March, 1862.]

In manufacturing figures, vases, mouldings: and other articles of artificial stone or cement, it has been usual, after casting the same, to leave the filled moulds for several hours, and even for days, in order that the cement might thoroughly set, and the cast bear handling. This tardy setting of the cement has rendered the use of a large number of moulds necessary, when workmen are required to be kept in continuous employment. Now the main object of the present invention is to expedite the setting of the cement, and thus to permit of the speedy removal of the casts from the moulds. This is effected by introducing into the water used to saturate the cement and bring it to a plastic state, ready for moulding, a fluid compound, consisting of a solution of carbonate of soda, or its equivalent, with sal-ammoniac and alum. By the combination of these substances with the cement, not only is the cement caused to set quickly, but its absorbent power, when set, is reduced, and the moulded article is therby rendered less liable to be affected by frost than the ordinary Portland or other cement castings, whilst its strength is materially increased.

The proportions of the chemical substances above mentioned, as forming the fluid compound, may be varied according to circumstances, but those usually preferred are as follows:—Supposing 30 gallons of water are intended to be prepared for mixing with the cement to be used for moulding purposes, take 1 lb. weight of carbonate of soda—or, in lieu thereof, $1\frac{1}{2}$ lbs. of carbonate of potash—and dissolve the same in one quart of water, to which add half an ounce of sal-ammoniac, and 1 ounce of alum or other equivalent salt of alumina. Throw this mixture into the 30 gallons of water, and then use the water in the ordinary way for reducing the cement to a plastic state. When the improvement of the colour of the cement is an object, introduce into the fluid compound a small quantity of an acid solution of indigo, which will neutralize the natural yellow hue of the cement. The proportion of indigo employed will depend upon the colour desired to be obtained, and must, therefore, be determined by the judgment of the workman. The invention also applies to the mixing of cements for plastering purposes.

When preparing the cement for plastering walls, mix therewith washed sand or river gravel, as is usual, and employ a larger proportion of water, to allow for the suction of the surfaces to which the cement is to be applied. If, however, the mixed cement is to be used for hydraulic purposes, increase the amount of fluid compound. Thus, for example, it is advisable, in mixing cement for hydraulic work, to add the propotion of fluid compound above mentioned to 20 gallons of water, which will naturally saturate a proportionately smaller amount of cement than that added to the above mentioned quantities of water prepared for moulding and for plastering purposes. When the cement to be mixed is fresh, the proportions given above, for the three several uses enumerated, will suffice to ensure a quick setting of the cement; but when the cement has, by age, arrived at the stage known to the trade as "dead," it will require a

somewhat increased proportion of the fluid compound. The weather and climate, also, affect these proportions; an excess of the fluid compound being required in cold latitudes, and a smaller proportion in warm weather or hot climates. Besides using the fluid compound for mixing with Portland, Roman, and other cements used in buildings or for moulding purposes, it is proposed to steep the moulded work in a bath of that fluid, after being trimmed or finished; and also to pay over coated wall or other surfaces with the fluid; as an improved appearance of the surface so treated is obtained, and a more complete filling of the pores of cement is ensured,—enabling it the better to resist moisture.

The patentee claims, "the treatment of cements, in the manner and for the purpose above described."

To James Thomas Grice, *of Birmingham, for improvements in the manufacture of twisted metallic tubes.*—[Dated 11th April, 1862.]

This invention relates to the manufacture of metallic tubes, of the kind commonly known in commerce as twisted tubes,—*i.e.*, tubes in which a convex or concave flute, or other pattern, is arranged in the form of a helix.

The patentee first fills the tube to be twisted with pitch, or lead, or sand, or other yielding substance, whether solid or in powder, and afterwards twists the filled tube, by fixing one end of the tube in a die or holding tool, and taking hold of the other end, by means of plyers or other tools, and applying a rotatory force thereto. Or a rotatory force may be applied to both ends of the tube, the motions being in opposite directions. The required twist or helical figure is thus given to the tube. After the tube has been twisted, the filling material is removed. Or a small rod or mandril of steel, or other hard unyielding metal or material, is placed in the tube to be twisted, instead of completely filling the tube with a yielding material. This rod or mandril is of much smaller diameter than the tube to be twisted; that is, it must have a diameter not greater than the diameter of the smallest part of the twisted tube to be made. The tube is twisted upon the small hard mandril in the same way as that described when a yielding material is employed in the tube.

By the use of a yielding material, or a hard mandril of small diameter, in the metallic tube to be twisted, the tube is prevented from collapsing while being twisted, and a very uniform twist is given to the tube. As the surface of the tube is untouched during the twisting process, the invention is especially applicable to the twisting of tubes, the surfaces of which have been ornamented previous to twisting.

The patentee claims, "the improvements in the manufacture of twisted metallic tubes hereinbefore described,—that is to say, filling the tube to be twisted with a yielding substance, either solid or in powder, or inserting in the tube to be twisted a small solid mandril of steel or other hard substance, for the purpose of preventing the irregular yielding of the tube during the twisting process."

To James Howard *and* Edward Tenney Bousfield, *both of Bedford, for improved apparatus applicable to steam cultivation.*—[Dated 1st January, 1862.]

This invention relates, firstly, to improved means for regulating the paying-out or running-off of the slack rope from the barrels of windlasses used in steam cultivation. Windlasses, as at present constructed, with two winding barrels, on to which the traction ropes are alternately coiled, and from which they are also alternately uncoiled, require the application of a brake to that barrel which for the time is paying out rope, in order to check its motion, and prevent the rope from dragging on the ground, between the rope porters or carriers: but this arrangement of the brake entails a loss of the motive power.

In order to regulate the paying-out of the slack rope, and prevent it from dragging on the ground between the porters, without being dependent on the retarding influence of a brake, the patentees propose to apply the lateral pressure of the drag or tension rope, to keep the slack rope from uncoiling too rapidly from its barrel.

Fig. 1, Plate XI., represents the improved snatch block in plan view. By an inspection of this figure, it will be seen that the addition of a guide or friction roller is made to the ordinary double snatch block, which block, when in use, is placed in front of the windlass; the ropes being carried from the pulleys of the snatch block in any required direction.

A, is the guide or friction roller, grooved on its periphery, and furnished as shown best in the sectional view, fig. 2, with shoulders *a*, *a*, which are intended to bear against the edges of the pulleys B, B^1. This grooved friction pulley is made somewhat to exceed in diameter the breadth of the space between the pulleys B, and B^1, of the snatch block, in order that it may divert the ropes out of a straight line. It is mounted on a stud, carried by a rock lever C, which has its fulcrum on the snatch block frame. This rock lever is placed between the pulleys B, B^1, in such a manner that the draught strain of the hauling rope will press the roller A, into contact with the pulley around which the paying-out or slack rope is passing. As the draught rope passes to the windlass, it will drive round the pulley A, by bearing against the inclined edges of the pulley B^1, and will set that pulley in motion; but, by reason of the friction surfaces of the pulley B^1, having a greater radius than the seat of its groove, the pulley A, by rotating it by friction of contact, will have a tendency to drive it at a surface speed slightly inferior to that of the draught rope. The result of this action is to prevent the slack rope running off its barrel at a greater speed than the draught rope. D, D, are small guide rollers mounted on the rock lever C, and held up to their work by means of elastic tail-pieces E, attached to the rear end of the horns in which the rollers are mounted. These rollers serve to keep the rope in close contact with the pulleys B, B^1.

The second part of the invention relates to the construction of double-action ploughs or cultivators, to be operated by steam power.

Fig. 3 is a plan view, and fig. 4 an elevation, of so much of the implement as will serve to explain the improvements; which consist in a novel arrangement for suspending the ploughs out of work, and in a simpler and better arrangement than has heretofore been adopted for steering the

implement. The two sets of plough bodies, or cultivator tines (for working alternately, as the implement moves from headland to headland in either direction), are carried by two distinct sets of beams A, A, and A^1, A^1, mounted in a carrying frame B. These sets of beams, instead of rocking on a common centre, are mounted on separate axles, or fulcrum rods, one axle for each set, and the sets of beams are so arranged as to overlap each other at their inner ends. This overlapping is effected by placing the separate fulcrum rods or cross axles of the plough beams one on either side of the centre of the implement. The beams are severally so arranged with respect to each other as to admit of the two sets of beams working freely between each other, at their inner ends; and by this means the length of the implement is reduced. The carrying frame B, in which the beams are mounted, is supported by three side wheels, viz., the furrow wheel C, and the land wheels D, and D^1. The implement is steered by moving or locking the two "land" wheels simultaneously; the "furrow" wheel, or that on the opposite side, having no locking motion. The furrow wheel is mounted on a stud axle, projecting from the centre of one of the side frames, and the other wheels are mounted upon wheel stalks E, E^1, having their bearings in the opposite side frame. To the upper ends of these wheel stalks levers F, F, are keyed, and jointed to the inner extremities of these levers are rods G, which stretch across the implement, and are coupled to a double-handled steering lever H: when, therefore, it is desired to steer the implement, it is only necessary to turn the lever H, on its fulcrum I, in the proper direction, and the land wheels will simultaneously move, either into the position shown by dots turning inwards, or that indicated by the dotted lines turning outwards, according to the course it is desired to direct the implement.

In order to raise the ploughs or cultivators from the ground, two pairs of chains are employed, which are attached to the outer beams, and carried over pairs of excentrics, or cam pulleys K, K, to which they are respectively secured. These cams are mounted on short axles, having their bearings in standards, bolted to transverse bars, which serve, also, to connect the two side frames together. These short axles are set midway between the fulcrum rods or axles of the two sets of plough beams, and their cam pulleys are so arranged, and operate in such a manner, that the set of suspended ploughs, or those out of work, will not, by their weight, raise the set that are depressed and in action from their work. The balancing tendency of the sets of ploughs is removed, when the implement is at work, by arranging the excentric pulleys as shown at fig. 4; the largest radius of the cam pulleys of the working set being opposed to the smallest radius of the cam pulleys of the suspended set.

The patentees claim, "First,—the application to snatch blocks of automatic apparatus for regulating the delivery of the slack rope, through the agency of the draught rope, as above described. And, Secondly,—the mode of suspending the beams, and of steering double-action ploughs or cultivators, as above described."

To JAMES HOWARD, EDWARD TENNEY BOUSFIELD, *and* THOMAS PHILLIPS, *all of Bedford, for improved apparatus applicable to steam cultivation.*—[Dated 11th April, 1862.]

THIS invention relates, firstly, to an improvement in windlasses for haul-

ing ploughs or other cultivating instruments, whereby the power used in driving them may, to a certain extent, be economised. It has been found that this class of windlasses, when constructed with two winding barrels which severally pay off and take up the rope alternately, require the application of brakes to check the too rapid paying off of the rope, but the use of brakes, as hitherto applied, has entailed a material loss of power, and that without having fully effected the object for which they were employed—namely, keeping the slack rope clear of the ground.

In order to avoid the defects of brake blocks, it is proposed to substitute therefor a pair of revolving discs or rollers, applied in such manner that, on the throwing of the barrels in and out of gear, that barrel which, for the time, is to give off the slack rope, shall, when it falls out of gear, bear upon a disc or roller, and receive rotary motion therefrom.

In Plate XI., fig. 1 is an end elevation, partly in section, of the improved drop-barrel windlass, with the improved brake arrangement applied thereto. A, A^1, are the barrels or drums for receiving and giving out the rope. These barrels are mounted on excentrics B, B, which are loose on the shaft C. This shaft is mounted in bearings in the side framing of the windlass, and is fitted with carrying wheels, as usual. The barrels or drums are formed with annular recesses a, a^1, on their inner or adjacent ends; one side of the recess being furnished with spur teeth, and the other being left plain, and constituting a friction surface for the discs or rollers D, D^1. The other ends of these barrels also carry a ring of spur teeth b, b^1, as usual, into which gear pinions c, c^1, on the driving shaft E. The discs or rollers D, D^1, are cogged on a portion of the breadth of their periphery, but in such a way that the teeth do not project beyond the smooth portion of the periphery. This arrangement is adopted to allow of the rollers alternately gearing into the ring of teeth in the annular recess like spur pinions, and working like friction rollers upon the friction surface on the other side of the annular recess. The rollers D, D^1, are keyed to a short shaft F, which has its bearing in the central bracket arm G, through which pass, at its opposite extremities, the shafts C, and E. It will now be understood that, if the windlass barrels are in the position shown at fig. 1, the barrel A, will be the winding up barrel, it being driven by the pinion c, in gear with the teeth b, on the barrel. While the barrel A, is in this position, the cogged roller or disc D, will be in gear with the teeth of the recess a, and it will, therefore, receive an axial motion from the barrel, which motion will be communicated to the roller D^1; as, however, the barrel A^1, is out of gear, it will bear upon its disc or roller D^1: this barrel will, therefore, be driven by friction of contact with the roller D^1, and caused to let out the slack rope at the requisite speed. When it is required to change the relative positions of the barrels, this may be readily effected by means of the hand levers H, and H^1, attached to the excentrics B, B^1. By rocking the lever H, the excentric B, will turn on the shaft C, and cause the barrel A, to fall out of gear—thus making it the slack rope barrel. In like manner, the barrel A^1, may be raised by its excentric B^1, thereby making that the winding-up barrel.

From the above explanation it will be understood that the driven barrel will cause, by friction of contact with its roller, the roller of the slack

rope barrel to regulate the speed of its barrel, and allow it to rotate only at a given relative speed, by reason of the friction of contact between that roller and the loose barrel.

The second part of the invention relates to an improvement in the construction of travelling anchors; the object being to avoid the defect now experienced when using them in short fields, where (the lateral traverse of the anchor depending on the length of rope run over the pulley) the automatic traverse of the anchor is not found sufficient to enable the plough or other implement properly to enter new ground.

Fig. 2 is a side elevation of the improved anchor, and fig. 3 is an end view, partly in section. It consists of a rectangular frame A, in the centre of which is mounted a horizontal grooved pulley B, for receiving the wire rope, and through the friction of which upon its periphery, rotary motion is imparted to the pulley. The spindle of this pulley carries a bevil pinion C, which gears into a bevil wheel D, mounted on a short cross shaft D^1. This shaft D^1, has its bearings in brackets A^1, A^1, attached to the main framing, and either end of this shaft is connected by toggle joints to shafts D^2, D^3, which are supported in bearings formed in a pair of hand levers *a*, *a*. These hand levers are hinged to brackets A^2, which are bolted to the sides of the framing A. The several shafts D^1, D^2, and D^3, together form a compound transverse shaft, and communicate the motion derived from the pulley B, to a pair of carrying wheels E, E, through pinions F, on their extremities, which pinions gear with rings of teeth e, e^1, carried by the wheels E. These wheels are furnished at their periphery with transverse leaves e^2, shaped so as to facilitate their piercing the ground by the mere weight of the anchor, their use being to bite the earth, and effectually prevent the wheels from slipping, when a driving motion is imparted to the carrying wheels. The object of providing these wheels with two concentric rings of teeth e, e^1, (as shown at fig. 2) is to allow for the propulsion of the anchor, by means of both the taut and slack rope; the attendant, by means of the levers *a*, *a*, throwing the pinions F, into gear with either the ring of teeth e, or e^1, according to the direction of motion, for the time being, of the running rope over the pulley, the course of which rope determines the direction of rotation of the driving gear. The anchor is held in position by blades G, which slide in guides formed for them in the framing, and they are forced into the ground by screwed rods H, secured to fixed lugs, or by any other suitable mechanical contrivance. In order to steer the anchor, it is only necessary to throw one or other of the pinions out of action, which can be readily done, by means of the levers *a*; the gearing being so arranged, that either of the travelling wheels can be driven independently of the other.

The invention relates, lastly, to an improvement in the construction of rope porters, which are used for supporting the wire rope clear of the ground.

Hitherto the pulleys of rope porters have been so mounted in the frame as to render it necessary, either to turn over the frame to release the rope, or to lift it off the pulley. To avoid this operation, which involves a loss of time and expenditure of muscular force, is the object of the improvement.

Fig. 4 is a side elevation of the improved rope porter. The improvement consists in mounting the roller or pulley at the end of a hand lever bar, that is capable of rocking on the frame of a wheel carriage. When, therefore, it is required to release the rope from the pulley, in order that

the porter may be removed, to clear the course for the plough, it is only necessary to tip the lever bar, and depress the pulley—the rope will then slip out of the groove of the pulley. A, A, shows the frame of the carriage, composed of two curved bars, the lower ends of which bear upon the ground, the upper ends forming bearings for the axle B, to which the carrying wheels are attached. C, is the hand lever bar, having its fulcrum on the frame A, and carrying at its extremity the grooved pulley D, which is surrounded by a guide-piece E. This guide-piece is open at its upper end, to permit of the rope being applied to the pulley. Jointed to the frame A, is a catch or holdfast F, for maintaining the bar C, in its raised position, as shown at fig. 1. G, is a tie rod, for strengthening the frame. It will now be understood that, as the plough is approaching the rope porter, the attendant has simply to release the long end of the lever bar from the catch or holdfast F; the weight of the rope, with little or no assistance, will then lower the pulley carried by the short end of the lever C. The rope will, by this means, be instantly released, leaving the frame free to be drawn sideways out of the track of the plough.

The patentees claim, "First,—regulating the giving off of the slack rope of windlasses, by friction gearing, in the manner above described. Secondly,—ensuring the automatic traverse of the anchor, by the action of the taut or slack rope, in the manner above described. Lastly,—mounting the pulley or roller of rope porters on a rocking bar, or its equivalent, for the purpose above set forth."

To COLLINSON HALL, *of Navestock, Essex, for improvements in implements for breaking up the soil, and in ropes and drums to be employed in the cultivation of the soil by steam.*—[Dated 11th March, 1862.]

THIS invention consists, first, in constructing implements for breaking up the soil as follows:—A sharp cutting steel bar, of any convenient width, is set at an angle to the line of draught, whereby the depth it travels under the surface is regulated. Into this bar is screwed, at intervals, sharp cutters, which direct the soil, and at the same time raise the weeds and roots to the surface. According to the shape of the cutters, so will the soil be turned.

Hitherto, wire ropes have been used for drawing implements in steam agriculture, and they become soon worn, and possess other defects. Now, the second part of the invention consists in constructing ropes, as hereafter described, which are substitute dfor wire ropes; and drums are used with such ropes, which are constructed as hereafter described. Bars or rods of steel are employed, of a length determined by the length of the divisions of or on the drum, and the bars or rods are united by means of short links, or by pins. The drums are formed with the periphery divided into parts, the length of which corresponds with the length of the bars or rods in the chain to be used with it, with a space or provision for the reception of the link or joint between every two bars or rods. For instance, the drum may be composed of three sides or divisions, the surfaces of which may be flat or curved for the bars or rods in the rope to bear against or be received upon, while the links or joints would be received upon or in the parts forming the ends of the divisions. Again, the drum may be circular, with sunk recesses for the reception of the

connections between the ropes. Drums made according to this invention will always have a direct grip upon the ropes constructed according to the invention, the drums and ropes being calculated to be used together.

The figure in Plate XI. is a horizontal section of one of the drums, with the periphery divided into parts, on which the improved rope is shown. The drum should be formed of several segments, which, when united, constitute a complete drum. Each segment carries a flat division or part *a*, equal in length to one of the bars of the rope to be used with the drum; also a flat part d^1, in which a tongue is inserted for the reception of the links between the bars. Each segment is united to that next to it by a flange, formed on one end, taking into a corresponding groove or aperture in the next segment, and so on for the whole periphery. The segments are secured by bolts passing through the apertures *f*, *f*, to a bed *g*, of the drum; *h*, *h*, are the tongues in the parts d^1, d^1. The segments are duplicates of one another, to allow, in case of one breaking, of another being easily substituted: at the same time the circumference of the drum can be increased or diminished by adding to or taking from the number of segments. The drum should be formed with an odd number of segments, for example, 5, 7, or 9. To facilitate the lengthening and shortening of the rope, the bars are connected to the links at intervals by screw bolts instead of rivets, to enable additional bars and links to be readily added, or to enable bars and links to be removed.

The patentee claims, "manufacturing ropes employed in the cultivation of the soil by steam, consisting of bars or rods, of iron or steel, united by links, as described, and the construction and employment, with such ropes, of drums, the periphery of which is divided into parts,—each separate part corresponding with the length of the bars in the ropes, and with a space for the reception of the links, in the manner described."

To ROBERT BOBY, *of Bury St. Edmunds, Suffolk, for improvements in hay-making machines.*—[Dated 26th March, 1862.]

IN this improved hay-making machine, the rotating teeth or tines are supported in a raised position, nearer to or further from the ground, as may be desired, by the aid of a disc adjustment, which couples the side frames to the front bar of the machine. The shafts are attached to this front bar, which carries part of the disc adjustment, and they are, therefore, capable of being turned upon a central point or axis, which will admit of the travelling wheels being lifted off the ground, so that they may be removed, or taken off their axles, without inconvenience.

In Plate XII., fig. 1 represents, in plan view, one of the improved disc couplings of a hay-making machine, and fig. 2 is a side elevation of the implement. *a*, *a*, are the travelling wheels, which turn upon stud axles fixed to the side frames *b*, *b*, of the machine; *c*, is the axle of the revolving fork-head cylinder, which rotates in bearings secured on the ends of the side arms in the usual manner. If it be desired to cause the cylinder to rotate in either direction, the teeth or tines must be made straight instead of curved, as is usually the case. *d*, is the front hollow shaft bar, to which the shafts *e*, *e*, are secured, and carries at each end the discs *f*, *f*. A straight rod *g*, (seen best in the detached figs. 3 and 4) passes through the hollow front shaft *d*, and also through the discs f^1, f^1, which are

secured to the wrought-iron side bars *b*, of the framing. The rod *g*, is provided at one end with a head, and is screwed at the other end, and carries a nut g^1; so that, by turning or screwing up the nut g^1, the surfaces of the discs *f*, and f^1, may be brought into close contact, and thereby form a friction clutch, which will retain the parts in any desired position.

Fig. 3 is a sectional view, and fig. 4 an elevation, of two forms of this disc adjustment. In fig. 3, simple flat discs or plain surfaces *f*, f^1, are employed; but these surfaces may be made conical, as shown at fig. 4, if preferred. If, however, it be considered desirable to employ discs with roughened surfaces, these surfaces may be provided with radial teeth or projections, as shown at fig. 5, which is a modification of the friction disc arrangement. The conical surfaces in fig. 4 are also serrated. Or, instead of teeth, as shown at figs. 4 and 5, one of the discs, *f*, or f^1, may be provided with projecting pins or studs, as shown at fig. 6, and which may be made to take into corresponding holes in the other disc. It will now be understood that the side frames and shafts may be turned upon the axis of the rod *g*, as a centre of motion when the nut g^1, is loosened. The relative positions of these parts will be thereby modified or changed, and they may be secured in their new position by simply screwing up the discs *f*, and f^1, tightly together.

The patentee claims, "the adaptation to the front bar or shaft bar of hay-making machines of an arrangement of friction discs or surfaces, as herein set forth, whereby the position of the teeth or tines nearer to or further from the ground may be adjusted as may be required."

To Robert Charles Ransome, *of Ipswich, for improvements in thrashing and other machinery where corn or grain is required to be raised from one level to another.*—[Dated 31st March, 1862.]

This invention relates to improved means for raising in thrashing and other machinery, corn or grain from one level to another.

In Plate XI., fig. 1 shows a vertical section of apparatus constructed and combined according to this invention. *a*, *a*, is a wheel, on the periphery of which are fixed propellers or paddles *b*. The wheel *a*, is mounted on the axle *c*, which turns in suitable bearings. To the axle *c*, a quick rotatory motion is to be communicated. The sides of the periphery of the wheel *a*, are enclosed in a case *d*, *d*, in such manner that the periphery of the wheel closes the case in that direction; hence the outer air is excluded from entering the case, and consequently the apparatus is prevented from creating a blast of air. *e*, is an opening into and near the bottom of the case *d*, by which the corn or grain is allowed to enter the case and to flow against the periphery of the wheel *a*, *a*. When at work, the lower part of the case *d*, near the opening *e*, as well as the pipe or passage leading thereto, will be filled with grain. As, therefore, the paddles or propellers *b*, pass the opening *e*, in succession, they will put the grains in motion; and by the time a paddle or propeller *b*, comes to the outlet *g*, at the upper part of the case, the grains of corn, so put in motion, will have attained the speed of the propeller or paddle, and will, by the centrifugal force imparted to them, fly through the outlet *g*, and up the inclined shoot or passage connected therewith. The inlet passage *e*, is to have a suitable pipe or chamber applied thereto, into which a constant

supply of wheat or other grain is to be kept up. The outlet *g*, is to have an inclined pipe applied thereto, to direct the grains to the position where they are to be delivered, whether on to a riddle or otherwise.

The paddles or propellers *b*, applied at the periphery of the wheel *a*, *a*, may be enclosed at the sides, so as to form rectangular buckets or chambers all round the periphery of the wheel, such chambers or buckets being each closed at the bottom and at the four sides, but open outwards or at the top. This arrangement is shown in section at fig. 2. The description above given will apply to this figure, the only difference in the construction of the two apparatuses being, that the sides of the periphery of the wheel in fig. 2 are closed, and there are more propellers or paddles used than in fig. 1.

Fig. 3 is a transverse section, and fig. 4 a vertical section, of an apparatus differing from the preceding ones, inasmuch as the wheel *h*, is formed with radial propellers or paddles *i*, *i*, projecting from the side of a conical surface, and such wheel is caused to revolve in a case *j*, which is a hollow cone; by this means a number of radial channels *k*, *k*, are formed between the curved propeller or paddles *i*, which channels *k*, expand as they proceed from the centre outwards. It is not essential that the paddles or propellers *i*, *i*, should be curved, as they may be straight and radiate direct from the centre outwards; neither is it essential that the surface of the wheel where the propellers or paddles *i*, *i*, are applied, should be conical, as the same may be flat, the side of the case being made to correspond. *l*, is an inlet passage at the centre of the case, to which a proper supply pipe, passage, or chamber is to be applied, so as to keep up a constant supply of grain thereto. *g*, is an outlet passage, to which a suitable pipe or passage is to be applied as before explained. The object of this part of the invention is to construct and apply apparatus acting on the corn or grain by centrifugal action, and at the same time to avoid creating a blast of air by the apparatus. Apparatus, such as herein described, is to be applied to thrashing machines in place of the apparatus heretofore used; or like apparatus may be applied in other places where corn or grain is desired to be raised.

The patentee claims, "First,—the combined arrangement of apparatus for raising corn or grain described with reference to figs. 1 and 2; and, Second,—the combined arrangement of apparatus for raising corn or grain described with reference to figs. 3 and 4."

To WILLIAM CLARK, *of Chancery-lane, for improvements in preserving timber; which are particularly applicable to the timbers of ships or other maritime structures,—being a communication.*—[Dated 7th February, 1862.]

THIS invention consists in a peculiar arrangement for carbonizing large wooden constructions, such as the hulls of ships. In order to effect the preservation of the wood in a comparatively short time, the wood must be deprived of the greatest possible amount of sap, and consequently of the fermenting properties it contains. The wood, before the parts are put together, should also be submitted to an artificial desiccation, and the face of the wood, when the work is finished, should be slightly carbonized.

In order to deprive the wood of its sap, it is plunged into soft water,

which, being less dense than the sap juices, forces out the latter, and fills all the fibres of the wood in its turn. The wood, after having thus imbibed the water, and being entirely deprived of sap, is placed in the open air to be dried, which may be effected in a short time, according to the size of the wood blocks, either completely or artificially. The wood may be artificially dried by means of an apparatus of Messrs. Légé and Henry Pironnet's invention for injecting poplar and beech woods with sulphate of copper: this apparatus consists of a cylinder, in which, after having introduced the wood and hermetically closed the end, a jet of steam is passed through the wood, in order to heat it and dilate the pores; after which, a vacuum is obtained by establishing a communication between the cylinder and a cold water condenser at the same time that the air pump is worked. The wood is then ready to receive a current of heated air, with which a certain quantity of sulphuric acid is mixed, in order to prevent any formation of fungi on the ship's bottom. A paint may also be applied below the water line, composed of flour of sulphur, 200 parts; linseed oil, 135 parts; boiled oil and manganese, 30 parts. This paint, by its sulphurous odour, will prevent all incrustation forming on the bottoms of ships.

After having been subjected to the above-mentioned treatment, the wood is finished, and put together in the usual manner. It now only remains to char the entire surface in order to preserve the wood. This operation is effected by means of a jet of gas, caused to impinge on the surfaces to be charred;—lighting gas, whether in a state of compression or not, may be used with advantage for this purpose; but if this is not to be had, hydrogen, or, still better, oxide of carbon, may be employed.

In Plate XII., fig. 1 shows an apparatus for the production of gaseous oxide of carbon; fig. 2 shows a second arrangement, also for producing gaseous oxide of carbon for charring railway sleepers. *a*, is the ordinary blowing apparatus; *b*, chamber, provided with fire bars forming the furnace; *c*, coal, serving for the production of the gas; *d*, tubes, leading to the gasometer; *e*, gasometer; *f*, nozzle, whence the jet of lighted gas escapes, which is directed on to the surfaces to be carbonized, like as if using a jet of water; *g*, cupola of refractory clay or metal, filled with crushed coke in small pieces, and carried by a grating *h*; *i*, tube, for the supply of air, forming a blowing apparatus; *j*, opening for cleansing the ash pit; *k*, opening made at the upper part of the cupola for the passage of a piece of timber *l*, which is made to slide slowly, in order to effect the carbonizing operation. When a ship's bottom is to be carbonized in this manner, the charred surface is slightly roughened, and it may then be painted in the ordinary manner. Wood may also be superficially carbonized by employing inflammable liquids or pastes, which are first spread over the surfaces and then lighted. When constructing hulls of ships in ordinary, an error is committed in so enclosing the frame of the vessel as to prevent any communication with the exterior air. A good method would be to place the shell of the vessel in communication with the exterior air, by making small holes in the sides, which would not weaken the parts to any great degree.

The patentee claims, "First,—the method of extracting the sap from wood, as described; dissolving it by the action of endosmose. Secondly,—the methods of artificially or naturally drying wood, as described. Thirdly,—the method of carbonizing wood by the aid of a jet of inflam-

mable gas of any suitable nature, which is projected on the wood in position; which process is especially applicable to the hulls of ships. And, further, the preservation of the hulls of such ships by the application of a sulphurous paint, as described, in order to prevent the formation of incrustations, said paint being applied on the carbonized parts. Fourthly, —constructing the shells of vessels so as to admit of air passing along the inside framing, in order to prevent the stagnated heated air decomposing the timbers."

To ALEXANDER STEPHEN, jun., *of Glasgow, for improvements in the construction of ships or vessels.*—[Dated 26th February, 1862.]

THIS invention has for object to prevent or diminish the injurious corrosion supposed to arise from galvanic action, such as that which occurs where the constructive details of ships or vessels consist of two different metals and wood, combined and disposed in such a way as to be accessible to moisture or water. The improvements consist in applying to such parts a protecting impervious or non-conducting covering, coating, or varnish, of a viscous, resinous, bituminous, or vitreous substance, such as waterproof glue; or a waterproof or insoluble cement, such as Portland cement; or a combination of such coverings, coatings, or varnishes, may be applied to the said parts.

This treatment is designed for use in constructing ships or vessels of wood and iron combined, as, for example, with frames of iron and planking of wood, and with or without an external sheathing of copper, or other metal or alloy different from iron, and it is equally applicable in all cases wherein different metals are combined in such a way, and are so situated or disposed as to be accessible to moisture or water.

The figure in Plate XII. is a longitudinal section of a portion of a ship's bottom, comprising an iron frame or floor A, the wood planking C, and one of the bolts D, of copper, yellow metal, or composition. In constructing the vessel, and before fixing the planking C, to the frame A, there is applied to the surface of the plank C, or to the surface of the frame A, at the parts E, immediately between the two, and surrounding the hole for the bolt D, a layer or coating of any of the substances hereinbefore mentioned, A convenient substance for the purpose is waterproof glue. The bolt hole in the frame A, is, by preference, punched from the outside, and it is, in consequence, slightly wider on the inner or upper side. Some of the coating substance is applied to the bolt hole in the frame A, and to the inside surface of the frame, so as to be between it and the washer F; and a little tow or oakum may be advantageously laid round the bolt, with the coating substance. The parts are then screwed hard together, by means of the nut G, and this has the effect of squeezing out the superabundant portion of the coating substance; leaving between the surfaces a compressed film, which fills the joints, and completely excludes moisture or water therefrom. It may not be necessary to apply the coating substance inside the bolt hole in the frame A, as the screwing up or compression forces it sufficiently into the hole, from the layer between the frame A, and the washer F; or a layer of red lead, with canvas, may be applied between the frame A, and the washer F. And it may also here be remarked, that canvas or other like material may be interposed at the joints, along with the coating substance, whatever this substance may consist of,—such

canvas or material preventing the coating substance from being reduced to too thin a layer, by the compression on screwing up, or otherwise binding the parts together. To complete the protection of the parts, the inner end of the bolt D, and its nut G, are covered by, or embedded in, a waterproof or insoluble cement, such as Portland cement H; this cement being, by preference, made to fill up the angle or corner of the frame A, on the side of the bolts, and being continued to fill up the corner at I, of the next adjacent frame. In a vertical direction, the cement is, by preference, continued of a uniform or nearly uniform thickness or depth, from the keel upwards, as far as it is considered necessary to protect the parts from moisture or water. By the combination of coatings or coverings thus described, double provision is made against the access of moisture or water to the parts where, from the immediate contact or propinquity of the iron frame A, and the bolt D, washer F, and nut G, (or any of them) of copper or other metal or metals different from iron, corrosion or injurious action might arise. Thus, the cement at H, and I, covers the outer edges or lines of the joints, whilst the impervious substance in the joints themselves will prevent the further progress inwards of the moisture or water, even if it should by any chance reach the outer edges or lines of the joints.

The patentee claims, "the applying, in the construction of ships or vessels, of a protecting impervious or non-conducting covering, coating, or varnish, of a viscous, resinous, bituminous, or vitreous substance, or a waterproof or insoluble cement, or a combination of such coverings, coatings, or cements, to the adjacent parts or joints occurring where iron is attached to wood, by means of bolts or other fastenings of copper, or other metal or metals different from iron, for the purpose and substantially in the manner hereinbefore described,—that is to say, in all cases wherein different metals are combined in such a way, and are so situated or disposed, as to be accessible to moisture or water."

To JAMES SIM, *of Aberdeen, N.B., for improvements in the construction of gas meters.*—[Dated 1st March, 1862.]

THIS invention relates to certain improvements applicable to the construction of wet gas meters, the principle upon which it is chiefly founded being that of causing the gas to pass over or come in contact with an extended surface of water, in a separate vessel or vessels; whereby it takes up, and absorbs or becomes saturated with, moisture, previous to being admitted into the measuring compartment of the meter; thus preventing the absorption of the water contained therein by the gas, as is the case when the latter is introduced in a dry state; the effect of such absorption necessarily being, to alter the level of the water contained in the measuring compartment. The water contained in the separate vessel or vessels is also constantly evaporating; the results of such evaporation passing upwards into the measuring compartment, and thus assisting in preserving the water level therein.

In constructing a meter in accordance with this invention, the front box thereof is divided into two compartments, one above the other,—the upper compartment containing the usual arrangements of valve, float, index, spindle with the necessary gearing to the measuring cylinder or

drum, the pipe for supplying water to the meter, and also the syphon overflow pipe, hereinafter mentioned, for adjusting the water line of the meter; while the lower compartment is used as a cistern or reservoir, for holding water, the same being provided with an overflow pipe, for the exit of any surplus water which may have been admitted thereto.

According to one modification of the invention, the lower compartment is constructed with one cistern or reservoir therein, or, if desired, it may be divided into compartments, it being essential, however, that such compartments should communicate with each other, so that the gas may freely pass through the same, for the purpose of traversing the surface of the water. The gas, having been admitted by the inlet pipe through the valve box, is carried, by means of a tube, into the cistern or reservoir, where it comes into contact with the water, and, passing along its surface, absorbs some portion thereof, and is conveyed in a hydrated state into the hollow covering of the measuring cylinder or drum. Any surplus water thus carried into the measuring compartment of the meter may be returned to the cistern or reservoir by a syphon attached to the inlet pipe, before the latter enters the hollow covering of the measuring cylinder or drum; the head of such syphon pipe being the water line of the meter. In filling the meter with water, it rises in the syphon pipe, overflows the head, and runs down the lower part of the inlet pipe into the cistern or reservoir. The syphon pipe thus furnishes a convenient mode of carrying off any water which may be set free from the hydrated gas in the measuring compartment, or which may be the result of evaporation from the cistern or reservoir, and constitutes an effectual method of adjusting the water level of the meter, and keeping it at the water line thereof, under ordinary circumstances.

In another modification of the invention, the front box of the meter is divided, as before mentioned, into two compartments,—the lower compartment containing two cisterns or reservoirs for holding water, one being placed over the other; sufficient space being left between them for the passage of the gas. In this arrangement, the gas passes by the inlet pipe to the lower of the two cisterns or reservoirs, and thence, along the surface of the water, through a pipe or passage, to the upper cistern or reservoir; and, after passing along the surface of the water contained therein, is conveyed, by a suitable inlet pipe, into the measuring cylinder or drum of the meter; the surplus water being allowed to return to the cisterns or reservoirs by a syphon pipe inserted into the inlet pipe, as before mentioned.

In order still further to increase the efficiency of the arrangements, the water in the lower compartment of the meter may be contained in trays, ranged one above another, and supported upon suitable lugs or brackets, in the interior of the lower compartment of the front of the meter, such trays being filled when the meter is supplied with water.

To prevent the consequences of the meter being tilted, the outlet pipe may be placed in the upper compartment of the front box, and carried down as near to the water line of the meter as possible, so as only to leave space sufficient to permit the gas to enter the tube.

In Plate XII., fig. 1 is a meter constructed with one cistern or reservoir only, in the lower compartment thereof; fig. 2 is a meter with two cisterns or reservoirs. A, A, is the shell or case of the measuring portion of the meter; B, and C, are the upper and lower compartments of the

front of the meter. *a*, is the inlet pipe for the gas, by which it is conveyed to the cistern or reservoir, and whence it passes over the surface of the water therein, in the direction indicated by the arrows, through the inlet pipe *b*, to the measuring cylinder or drum; *c*, is the syphon overflow pipe; *d*, is the pipe for supplying water to the meter; and *e*, is the overflow pipe from the lower compartment.

The patentee claims, "First,—the construction and arrangement of the said syphon overflow pipe, as and for the purposes mentioned. And, secondly, the arrangements and combinations of apparatus and mechanism in the construction of gas meters, as described, or any mere modifications thereof, for effecting the objects and purposes set forth."

To Richard Wright, *of Albany-road, Camberwell, for improvements in heating and clarifying saccharine fluids.*—[Dated 7th March, 1862.]

This invention has for its object the heating and clarifying of saccharine fluids, whereby improved results may be obtained.

The figure in Plate XII., represents a section of a vessel to be used for this purpose. This vessel is similar in construction to that used in combination with a series of discs, for the evaporating syrups or saccharine liquids, in the refining and manufacture of sugar. In the heating of saccharine fluids, for the purpose of clarifying them, as little evaporation of the fluids as possible should take place, and the process of heating and clarifying is effected in the vessel shown, without the employment of rotating discs or apparatus, as formerly used by the present inventor, for giving motion to, and for raising, thin films of such fluids out of the body of fluid.

A, is the vessel in which the saccharine fluid is placed, to be heated and clarified. This vessel is, by preference, to be semicircular in section, though other forms may be resorted to, and they may be of any desired length. The vessel A, is set in another vessel B, in such manner as to allow space below it for the reception of water, the level of which is not to be allowed to rise so high in the vessel B, as to touch the bottom of the vessel A. On the contrary, there is a space between the water in the vessel B, and the bottom of the vessel A, and the level of the water in the vessel B, is ensured by an overflow pipe C. In order that the water in the vessel B, may not rise above 212° Fahr., a pipe or opening D, is employed, which is at all times open to the outer atmosphere. The water in the vessel B, is heated by means of steam pipes or otherwise, and the saccharine liquids are drawn off from the vessel A, by means of a cock at E.

The peculiarity of this invention consists in clarifying saccharine fluids, by heating them in vessels which are heated by the vapour of water, in the manner described.

To Frederick Warner, *of Crescent, Cripplegate, for improvements in cocks or taps.*—[Dated 18th March, 1862.]

This invention embraces several improvements in the details of cocks or taps. On the valve spindle is formed a toothed rack, which is received into, and works within, the water or steam way of the tap or cock. The face of the valve is by preference circular, and is packed with a soft

packing, where it comes against its seat, which is preferred to consist of a projecting ring, with a thin edge to enter the packing in the face of the valve. Or the seat may be packed, or have a washer of soft material, and the projecting ring may be on the face of the valve. The toothed rack used is constructed as follows:—There is a slot formed through an extended portion of the spindle of the valve, on the inner surface of one side of which slot the teeth forming the toothed rack are formed in such manner that, when the pinion used with the rack is in its place, the diameter of the pinion nearly corresponds with the width of the slot. The axis of the pinion passes through a suitable stuffing box into the interior of the body of the cock or tap. This stuffing box is constructed in such manner that, by screwing down the packing which takes its bearing on the axis, the requisite friction is obtained to resist the tendency of the axis to turn with the force of the pressure of the fluid. It is preferred that the arrangement should be such that about a quarter turn of the axis of the pinion should be sufficient for opening and closing of the valve. The lower end of the axis of the pinion is pointed, and has its bearing in a suitable cup. The guide spindle of the valve is made three-sided, the sides being hollow, as heretofore, so that the water, or steam, or other fluid, may pass freely on the three sides of the spindle, whilst the three angles of the spindle serve to keep the valve and spindle correctly in the water or steam way. It is preferred that the valve should be arranged to open with the pressure of the water or other fluid, but this is not essential, as the valve may be arranged to open against the pressure of the fluid.

In Plate XII., figs. 1 and 2 show sections of two cocks or taps, constructed according to this invention. *a*, is the valve, which in fig. 1 opens with the pressure of the fluid, whilst the valve shown by fig. 2 is arranged to open against the pressure of the fluid; *b*, is the spindle of the valve, which is formed with a slot through it, as shown at fig. 3, and cogs or teeth are formed on the interior. The valve is formed hollow in the face, and is packed with vulcanized india-rubber, or other suitable material. The valve is provided with a projecting guide a^1, which is triangular, and bears at three points, leaving sufficient space between the guide and the barrel for the passage of the fluid. *c*, is the spindle of the pinion *d*, by which the rack and its valve is moved to and fro. The spindle *c*, may be formed suitable to receive a moveable key, or a fixed handle. The passage of the spindle *c*, into the body of the cock is packed as shown.

The patentee claims, "the combined arrangements herein described."

To Bewicke Blackburn, *of York-buildings, Adelphi, for improvements in apparatus for lubricating locomotive and other axles.*—[Dated 2nd April, 1862.]

This invention consists in placing the packing or stuffing used for spreading the oil on the journal, above the centre of the journal, and in contact with it, instead of below the journal; its position being such that the packing and the brass bearing shall wear away simultaneously, and thus the packing remains always in contact with the upper part of the journal as long as the bearing lasts.

In Plate XII., fig. 1 is a longitudinal section, and fig. 2 a transverse section, of apparatus applied to an axle constructed according to this invention.

Instead of placing the packing or stuffing, used for the purpose of spreading the oil, in a position below the centre of the journal, woollen or other capillary fillets *w*, *w*, fig. 2, are fixed to the brass bearing *b*, by the hooks *k*, *k*, or by other ordinary means, in a position above the centre of the journal *j*, and in contact with it. Thus they are in such a position that they can only wear away as the brass itself wears away, and they therefore remain in contact with the journal, and do not require renewing as long as the brass bearing lasts.

To HENRY WILLIS, *of Albany-street, Regent's-park, for improvements in valves for the supply and discharge of gaseous bodies.*—[Dated 30th April, 1862.]

THE object of this invention is so to construct valves, suitable for opening and closing passages for the supply and discharge of air and other gaseous bodies, that the pressure of such air or gas will not interfere with the free action of the valve, whether closed or open. To this end, it is proposed to apply the principle of buoyancy, for keeping the valve to its seat.

In Plate XII., fig. 1 shows, in sectional elevation, the invention, as applied to the supply of wind from the wind chest of an organ to the grooves or channels in connection with the pipes. In this arrangement, the valve consists of a vertical cylinder *a*, made of hard wood or other buoyant material, to which is attached an open cover, or it may be arms *b*. In the centre of this cover is inserted a rod *c*, leading down to a tracker, by which the valve is operated. The valve is so situated as to close the vent from the wind chest to the groove or air channel which it is intended to command, and it dips into mercury or other suitable fluid *d*, contained in an annular groove formed in a block *e*. This block serves also as a guide for the vertical rod *c*. The upper edge of the valve cylinder, it will be understood, is kept in close contact with the valve seat, by reason of the buoyancy of the floating valve and the pressure of wind. The wind chest, acting equally on the cylindrical surface of the valve, will have no tendency either to open or close it. All the exertion, therefore, required from the organ performer, in opening a passage for the wind, will be to overcome the natural buoyancy of the valve (the amount of which may be regulated with the greatest ease, either by weighting the valve or increasing its immersion), by depressing the tracker in connection with the rod *c*. When the valve is drawn down, the air will pass over it, in the direction of the arrows, but immediately the valve is released from the pull of the tracker, it will rise by its buoyancy, and close the vent; the free movement of the valve being ensured by the openings in the cover of the valve admitting air within the valve, and thereby equalizing the atmospheric pressure around it.

In some cases, it may be necessary to assist the closing of the buoyant valve, and the maintaining it in its closed position. This may be effected by the application thereto of a light spring (coiled, for example, round the valve stem, and acting on the inner side of the cover); or a rim may be formed on the top edge of the valve, for the compressed air in the wind chest to act upon. When applying the valve as an escape valve, or for

discharging gaseous bodies, under pressure, into the atmosphere, its cap or cover may be closed, but the inner part of the valve must be open to the atmosphere.

Fig. 2 shows, in sectional elevation, a modification of the buoyant valve. Instead of receiving a vertical motion, it is operated by a rocking motion, for which purpose the valve takes a segmental form, and is supported by rocking arms. *f*, is a curved or segment-shaped tube, carried by arms *g*, *g*, which rock upon a fulcrum *h*. This tube is open at its ends, one of which bears upon its seat *i*, and the other dips into mercury, glycerine, or other suitable fluid, contained in channels *k*, *k*, formed in the block *l*, the sections of which channels are struck from the fulcrum *h*. These channels are connected together, their plan view corresponding to the form of the tube in cross section (whether flat-sided or otherwise). The tube is weighted, as shown at *m*, to compensate for the increasing resistance of the buoyant principle, as the valve is pulled open. The drawing represents this rocking valve as applied to a wind chest, and commanding a vent *n*. A tracker for operating the valve is to be connected to the rod *o*, which, when pulled in the direction of the arrow, will cause the valve to rock, and open a way for the passage of the wind from the wind chest. The patentee remarks, that this valve may also be formed as a quadrant, to close a horizontal passage *p*, as shown by dots in fig. 2. This class of valve it is proposed, also, to apply for the purpose of ventilating buildings, as it will answer readily to the action of any suitable thermometric arrangement which may be readily applied thereto, for opening or closing it, according to the temperature of the apartment which it is intended to supply with fresh air. These valves may also act in pairs, being coupled together by segment racks, in order to increase the area for the supply of fresh, or discharge of vitiated, air.

Another modification of the buoyant principle is shown at fig. 3, as applied to an organ pallet valve; fig. 3 being a longitudinal section. The frame *q*, of the valve is connected, as usual, by a rod q^1, to the tracker, and it carries at its under side the valve q^2, the ends of which take a segmental form, as struck from the centre of the hinge of the valve. The edges of the valve dip, as in the first example, into mercury; a suitably-shaped channel being formed to receive it, in the block *r*.

When adapting the improved buoyant valve to gas regulators, it is fitted up by preference in the manner shown at fig. 4, which represents, in vertical section and in sectional plan, a modification of a Kidder's gas regulator, with the improvement applied thereto. The gas regulator consists mainly of two castings A, and B, the former of which, besides containing an inlet and outlet passage for the gas, is fitted with three annular channels D, D^1, D^2, for receiving mercury or other suitable fluid. B, is a cylindrical casting, which serves as a guide for the stem of the regulator, and also forms a seat for the buoyant valve C. This valve consists of an open cylinder, and is connected by arms to the stem of the bell or inverted cup E, so that both bell and valve rise and fall together. The bell is weighted, so as to regulate the flow of gas through the apparatus (whatever the pressure at which it is supplied) according to the well-known principle of action of the Kidder gas regulator. The cylinder B, is placed in the channel D^1, the mercury in which seals the joint. The bell E, dips into the mercury in the annular channel D, and the valve C, dips into the mercury in the channel D^2. When the gas is turned on from the

main, but none is being burned, the upward pressure of gas upon the bell E, will close the valve C. When, however, a supply of gas is required, and a vent is opened for the gas, the bell will descend and open the valve C, which will, however, throttle the central opening in the cylinder B, to the required extent, to ensure an equable pressure at the burners.

The patentee remarks, that, although the buoyant valve is capable of a very wide application, yet it is not proposed to employ it where heavy pressures (such as steam pressures) require to be resisted, as the depth of the mercury would, in such cases, be excessive.

The patentee claims, "the construction of valves in the manner and for the purpose above described."

To WILLIAM PICKSTONE, *of Radcliffe, Lancashire, for improvements in the manufacture of piled fabrics.*—[Dated 15th March, 1862.]

IN the manufacture of piled fabrics according to this invention, a fabric is woven consisting of cotton warp wefted with cotton yarn, to form the ground or body of the fabric, and it is also wefted with a mixed weft, consisting of cotton and woollen or worsted yarn, such mixed wefting being suitably carried or floated on the face, so as to admit of the mixed weft being cut into a pile as when weaving plush or velveteens.

In the manufacture of plush, velveteens, and other like fabrics, where the pile is produced from the face wefts employed therein, it has been the practice to employ in each case a face weft of only one description of fibre, by which the parts of the pile of a fabric, when dyed, have been of a uniform color. Now, by this invention, the pile of the fabric is of a mixed character or color, consequent on dyeing animal and vegetable fibre, when together, by the same dye. For this object, therefore, the patentee employs weft composed of animal and vegetable fibres for the face or pile weft of each fabric, and he manufactures these pile fabrics, in other respects, in like manner to what has heretofore been practised when weaving plush, velveteens, or other like fabrics, where the pile is produced from the face wefts employed therein. He usually combines cotton and wool, in any desired proportions, in preparing the face or pile of weft to be used in these fabrics; he does not, however, claim the manufacture of yarn composed of mixed animal and vegetable fibres, as yarn of mixed fibres has before been produced and used for other purposes.

To MICHAEL HENRY, *of Fleet-street, for an improved furnace for treating iron ore,—being a communication.*—[Dated 1st April, 1862.]

THE improved furnace forming the subject of this invention is shown, in vertical section, in Plate XII. *a*, is the belly of the furnace; *b*, is the sole or floor of the portion of the furnace called the "crucible or hearth." This sole *b*, is composed of sand and fire-brick; the bottom *c*, and sides *d*, of the crucible or hearth are of cast iron; the sides *d*, consist of four strong curved plates, firmly secured together from the bottom up to the bearers *e*, and lined with a layer of fire-brick and fire-clay, about fifteen inches thick; *i*, are annular plates, forming bearers for supporting the inner "shirt" or lining *h*, which is of fire-brick, and the boshes a^1, which

are also of fire-brick, which material also forms the belly; *e*, are annular or nearly annular plates, forming bearers for supporting the outer shirt or casing *f*, which is of common brick, hooped with iron; *j*, are cast-iron pillars, supporting the bearing plates *e*, and *i*; *l*, is a cast-iron damp-plate, which covers the front of the crucible or hearth completely, except that two openings are formed in it, one at bottom, to run off the metal when the furnace is tapped, and the other at top, forming the fore part of the hearth, and affording an outlet for the slag, which flows down by its own gravity (without requiring to be raked out), and drops into a wheeled truck or waggon. *m*, is a hinged plate, reaching to the tymp—it helps to close the upper opening in the plate *l*; *p*, is a moveable cast-iron cover or cap, for closing the mouth or throat of the furnace: it is hung by a chain *o*, from a cross bar fixed in the chimney *r*, and carries a balance weight, by means of which the cover *p*, may be drawn up to open the throat, when the charges are to be fed in. The cover gradually sinks as the operation proceeds (and the charges become reduced), and thus indicates the progress of the work, and it also serves to concentrate the heat within the furnace. When sufficiently depressed, it prevents the gases given off during the process from escaping into the chimney *r*, but forces them to find their way into an outlet *v*, through flues *s*, formed in the shirt, and communicating with an annular flue *t*, leading into the pipe *v*, through which these gases are conveyed into any convenient receiver; whence they may be taken and applied to the heating of lime-kilns and steam boilers, and other useful purposes. When the cap *p*, is raised, and the mouth open, the gases escape through the chimney *r*. *w*, are blocks for raising the crucible, when required.

The patentee claims, "the arrangement and combination of parts constituting the improved furnace constructed as described."

Scientific Notices.

INSTITUTION OF CIVIL ENGINEERS.

November 11, 1862.

JOHN R. McCLEAN, Esq., Vice-President, in the Chair.

Before commencing the business of the evening, on this the first meeting of the session, and in the absence of the President, the Chairman said it was his duty to notice the loss the Institution had sustained, by the death, during the recess, of two of its most eminent members, Mr. John Edward Errington, Vice-President, and Mr. James Walker, Past President.

For upwards of thirty years, and, indeed, ever since the introduction of the railway system, Mr. Errington occupied a prominent position as an engineer, and, in conjunction with Mr. Locke, executed some of the principal railway works in Great Britain. He was, like his partner, Mr. Locke, a strong advocate for economy in the first cost of construction. By his death the profession had lost one of its most distinguished members, the Institution one of its warmest supporters, and many of us a

sincere friend, and one ever ready to afford advice, especially to his numerous pupils and assistants, whose interests it was his constant endeavour to advance. As many of his pupils were actively engaged in the practice of the profession, and had, through his influence, been enabled already to take good positions, the Chairman expressed the hope that they would feel it a duty, no less than a pleasure, incumbent upon them, to communicate plans and descriptions of the works of their eminent masters, and so keep alive the memory of Locke and Errington in the Institution of Civil Engineers. Mr. Errington had proved his attachment to the Institution, and his desire to see it prosper, by bequeathing to it the sum of one thousand pounds, free of legacy duty, and without attaching any condition whatever to the gift.

Mr. Walker was one of the oldest members of the profession, having been in active practice as an engineer for upwards of sixty years. He was also one of the earliest members of the Institution, having joined it in the year 1823, and, after the death of Mr. Telford, became its President. For a period of eleven years, during which he so ably conducted its proceedings in that capacity, he was most devoted to its interests; and to his zeal and energy must be greatly attributed the eminent position it held on his retiring from the chair in 1845. Mr. Walker's name was associated with many of the greatest hydraulic works in England and Scotland, including lighthouses, harbours, bridges, embankments, and drainage. His opinion was much valued by the Elder Brethren of the Trinity House, by the Lords of the Admiralty, and by the Corporation of the City of London; and it must not be forgotten, especially at the present moment, that, twenty years ago, he laid down lines for embanking each side of the river Thames, which have never been improved. As the Chairman had had the privilege of being in Mr. Walker's employment for many years, prior to 1844, he had an opportunity of knowing his worth, and must express his gratitude for many acts of kindness, and state that it was Mr. Walker's constant endeavour to promote the interests of himself and others. Many members of the profession had also been trained in the same school, including Burges, Bidder, Hawkshaw, Borthwick, and Hartley. During his long and useful career, he had secured the admiration and respect of numerous influential friends, as well as the regard of his professional brethren.

The Chairman had much gratification in announcing, that Mr. Walker having left at Mr. Burges's disposal the twenty-five remaining copies of *Telford's Life and Works*, as well as the copyright and the copper-plates, Mr. Burges had, in the most handsome and liberal manner, presented them to the Institution.

The paper read, was "*On the Railway System of Germany*," by Mr. ROBERT CRAWFORD, Assoc. Inst. C. E.

IT was stated that in Germany, as in England, tramways had formed the germ from which subsequent enterprise developed the vast network of railways now extending throughout the length and breadth of the land. The oldest of these undertakings originated in a fifty years' "privilege," granted by the Austrian Government, upon the 7th September, 1824, for the construction of a line from Budweiss, in Bohemia, to opposite Linz,

on the Danube—a distance of upwards of 80 English miles. Subsequently, a concession was obtained for a line from Linz to Gmünden, 42½ miles. The cost of the Budweiss, Linz, and Gmünden line was about £4,877 per mile. The gauge was 3 feet 7½ inches, and it was worked by horses until 1854, when small locomotive engines were employed, first upon a portion of the line, and, in the following year, upon the entire length.

A proposal to adopt steam as a motive power, instead of horse labour, was carried into effect, for the first time in Germany, in the case of a railway, 4 miles in length, from Nüremberg to Fürth, which was opened for public traffic on the 7th December, 1835. Thus, Germany, possessing, at the close of the year 1835, upwards of 108 miles of tramways, had, up to the same time, only 4 miles of railway, properly so called. In the five following years, railways were introduced into all parts of the country, so that, at the close of 1840, there were twelve railways, either wholly or in part finished, with a total length opened of 377 miles. In the next ten years this had been increased to 4,487 miles; by the close of 1860 to 8,512 miles; and at the end of 1861, a total of 8,866 miles had been constructed, at an average cost of £16,400 per mile. Nearly one-fourth of the entire length was provided with double lines of rails. About 38 per cent. of the existing lines was Government property, 10½ per cent. the property of Companies, but worked by Governments, and 51½ per cent. the property of, and worked by, private or Joint Stock Companies. Further, it appeared, that 39½ per cent. of the entire length was constructed by the different States, 24¾ by Companies under a guarantee of interest, or a Government subvention, and 35¾ per cent. by Companies at their own cost and risk; so that Government aid had been granted, directly or indirectly, to nearly two-thirds of the entire system. These 8,866 miles of railway comprised sixty-two different undertakings, as at present constituted, under as many different organizations, and were managed by nineteen Government departments, and forty-three Boards of Directors.

At the close of the year 1861, Germany had, in addition to the railways, about 143 miles of tramways, constructed at an average cost of £3,200 per mile.

With a view of establishing a common plan of action, and of regulating, to a certain extent, the relations of the different railway companies with each other, a society was formed, in the year 1847, under the title of "The Association of Government Railway Directions," which now embraced the whole of the lines, with very unimportant exceptions. Each company subscribed a fixed sum towards the general management fund, together with a variable amount, depending upon its length, and was represented at the meetings of the association, and in the debates, in proportion to its importance. A code of laws had been drawn up and agreed to, which was revised from time to time; the rules expressing the decided opinion of the associated body upon all points usually involved in the construction and working of railways. The gauge was now universally throughout the country 4 feet 8½ inches. With regard to curves and gradients, the rules laid down were,—First, the radius of curvature should, if possible, not be less than 3600 feet in level land, nor than 2000 feet in hilly districts, except in particular instances, where it might be necessary to reduce it to 1200 feet, or even, in very rare cases, to 600 feet, but never less. Second,—the general scale of maximum gradients admissible on

railways was 1 in 200 in level districts, 1 in 100 among hills, and 1 in 40 on mountain lines. Several examples of sharp curves upon works already executed were then noticed. The increased power of locomotive engines had led to a severer character of ruling gradients being introduced than was formerly contemplated, and there were ample proofs, in every part of the country, that the limits, recognised at present as suitable for the working of locomotives, had been reached. Many instances were then given of steep gradients and sharp curves, including a particular account of the Semmering railway, and of the mode of working it. As, however, a description of this railway had been brought before the Institution by Mr. C. R. Drysdale, in the year 1856 (Minutes of Proceedings Inst. C.E., Vol. XV., p. 349), it would suffice to say, that the experience derived from the working of the line went to show, that one of the goods engines was capable of drawing up the inclines of 1 in 40, at the rate of 9½ miles per hour, a train, whose gross weight varied from 100 to 165 tons, according to the state of the rails and of the weather at the time. The ordinary rate of speed was fixed at—

	Ascending. Miles per Hour.		Descending. Miles per Hour.
For express trains	$14\frac{1}{7}$	....	$16\frac{1}{2}$
,, ordinary passenger	$11\frac{3}{8}$	....	$14\frac{1}{7}$
,, goods, including military transport	$9\frac{1}{2}$	....	$9\frac{1}{2}$

The maximum number of trains which had passed over the line in one day was seventy-two, counting both ways. This was during the Italian war. The ordinary number was twenty-seven, with from seven to eight carriages each. The line was about 25½ miles in length, was laid with a double way throughout, and had cost £98,270 per mile.

It appeared to be a general, although not a universal, plan, in the case of all main lines, to prepare the earthworks and masonry for a double way throughout, but not to lay the second line of rails until the success of the undertaking and the requirements of the traffic demanded it. Some of the heaviest earthworks executed up to the present day were then alluded to, including one on the Southern State Railway of Bavaria, the greatest height of which was 172 feet, and which contained nearly 3,000,000 cubic yards of material. A list of the largest tunnels on the principal lines was next given.

Viaducts and bridges were treated under two headings;—First, bridges composed altogether of masonry; and, second, iron bridges. The views of the Associated Railway Directions on bridge building were,—1st. For bridges, arches of stone or good bricks were preferable to every other description of structure, except in cases which required very oblique bridges. 2nd. Timber bridges were inadmissible. 3rd. When iron bridges were made use of, the portion of the structure which sustained the roadway should consist either of wrought or rolled iron. Thus, cast-iron bridges, as well as timber ones, were removed from the field of investigation; the former by negation, and the latter by direct condemnation.

Instances were then adduced, and details given, of several examples of stone viaducts and bridges, of imposing dimensions and extent, including those over the Goeltzsch and the Elser Valleys, on the railway from Leipzig to Hof, and the Neisse Viaduct on the railway from Kohlfurth to Goerlitz, in Prussia. The result of a series of experiments, for the pur-

pose of ascertaining the best description of concrete to be placed round the foundations of the river piers in the latter case, gave proportions most suitable for yielding a quick setting—hard concrete at 22 per cent. of cement, 22 of sand, and 56 of small broken stones, not exceeding 2 inches diameter. In regard to the bridge over the river Neckar, on the railway from Frankfort-on-Maine to Heidelberg, it was stated that the depth of the keystone was somewhat over the minimum required both by Desjardin's formula and by that of Gauthey; but, on the other hand, it was so out of proportion with the huge thickness obtained from the method of Perronet, as to prove the total unfitness of this system for calculating cases similar to the one in question. Thus,

	Metres.
The Neckar Bridge, as actually built, had a depth of key of.........	1·200
„ according to Gauthey's formula it required.........	1·125
„ „ Desjardin's „	1·140
„ „ Perronet „	3·241

In the case of wrought-iron bridges, the arrangement most usually adopted, when the spans were wide, was that of a lattice construction, in some one of its various modifications. One of the earliest examples, which was described in detail, was the bridge over the river Kinzig, at Offenburg, on the Baden State railway, in which it was considered that the arrangement of the material was not judicious, as,—first, the dimensions of the ironwork were uniform throughout the length of the span; second, although a stronger lattice construction was adopted in the case of the central girder, still the top and bottom sections were of similar dimensions to the outside ones; and, third, the cross sectional area of the iron had not been properly proportioned to its different powers to resist compression and extension where those forces acted. The bridge over the river Vistula, at Dirschau, on the Eastern Railway of Prussia, was next referred to. It consisted of six spans, each 397 feet 6 inches in the clear, the depth of the girders being 38 feet 9 inches, and the whole of the material in the superstructure being carefully proportioned to the nature of the strains to which it would be exposed. The Marienberg bridge, over the river Nogat, on the same railway, was likewise minutely described. The next examples selected were those over the Rhine, at Cologne, and at Kehl, close to Strasburg; in the latter case, the method adopted in constructing the foundations, by means of compressed air, was also mentioned. It was stated that the operation of sinking the foundations progressed at the rate of about twenty inches per day of twenty-four hours.

In addition, there was also another bridge over the Rhine, at Mayence, which consisted of thirty-two openings, having together a clear waterway of 3134 feet 6 inches lineal measure. The ironwork in the superstructure was somewhat similarly arranged to that of the Saltash bridge, modified, in some particulars, as to the cross section, and the form in which the material was applied, according to what was known in Germany as the system of Professor Pauli, of Munich, which gave a rectangular top to the beam instead of an oval one.

Attention was then directed to the permanent way. It appeared that about seven-eighths of the rails in use were of the broad base, or contractor's pattern: the remaining one-eighth being composed chiefly of chair rails, with a small proportion of bridge-shaped ones. As to size, the rails were not less than 4½ inches in height, by 2¼ inches width of

head, and the surface was curved to a radius of from 5 to 7 inches. They weighed, generally, from 66 to 76 lbs. per yard. Fish-plates were now almost universally adopted for connecting the ends of the rails, and the joints were always supported by a sleeper—a wrought-iron chair being interposed between the rail and the timber. Recently, a trial had been made of the modern English system of leaving the joint free, without any sleeper under it, and the result had been so satisfactory, that it was intended to extend it. The almost universal system of supports was that of cross-sleepers. They were of oak, where it could be procured at a reasonable price; but different descriptions of larch and fir were often used, after being prepared by some chemical process, to resist the tendency to decay.

The quantity and description of rolling stock in use on different railways in Northern and Southern Germany varied greatly; but, as nearly as could be estimated, at the close of the year 1861, there were—

Locomotive engines..	0·414 per English mile.
Passenger carriages, average 41·8 seats each............	0·807 „
Goods trucks, average load 6·9 tons........................	7·040 „

Before any engine was permitted to be used, its boiler must be tested with hydraulic pressure, to at least one and a-half times the maximum steam pressure which it was intended to sustain, and a similar test must be applied after the engine had run its first 46,109 miles, and be subsequently repeated every time an additional 36,887 miles had been made. The rate of speed was usually, for express trains, from 27 to 35 miles an hour; for ordinary passenger trains, from 20 to 25 miles; and goods trains, from 10 to 15 miles per hour—in each case exclusive of stoppages.

INSTITUTION OF MECHANICAL ENGINEERS.

July 1, 2, and 3, 1862.

SIR WILLIAM G. ARMSTRONG, PRESIDENT, IN THE CHAIR.

The annual special meeting of the society was held at the Royal Institution, Albemarle-street, when the first paper read was, *On surface condensation in marine engines*, by Mr. EDWARD HUMPHRYS, of Deptford.

THE subject of surface condensation in steam engines, especially in marine engines, was first brought to the notice of the writer in 1833, by the proceedings of Mr. Samuel Hall, then of Basford; and it is more with the view of drawing attention to the success with which this system was practised a quarter of a century ago, than of describing any new combinations possessing advantages over the plans then adopted, that this paper is submitted to the meeting; indeed, nearly the whole of the practical details about to be given were published fully twenty-seven years ago.

The writer's brother, the late Mr. Francis Humphrys, was employed by Messrs. John Hall and Sons, of Dartford, to design the engines

made by them for the paddle-wheel steamer "Wilberforce," of 280 nominal horse power, and the writer thus had the opportunity of witnessing the designing, manufacture, and working of the surface condensers fitted to these engines. Drawings of the engines are given in *Tredgold on the Steam Engine*, together with indicator diagrams taken from them in 1838; and up to the present time, the writer is not aware of any better vacuum having been produced. He started these engines the first time they were set in motion, in the year 1837, and has a distinct recollection of the admirable manner in which the condensers did their duty. The vessel was employed between London and Hull, until 1841, when the outsides of the condenser tubes having become very thickly coated with mud from the Thames and Humber, the tubes were removed, and injection was substituted.

About fourteen years ago, when the writer held the appointment of engineer-in-chief of Woolwich dockyard steam factory, he had a second opportunity of obtaining practical information as to the working of Hall's surface condensers, from the "Grappler," which returned to Woolwich after a three years' commission abroad, having been fitted with the surface condensers by Messrs. Maudslay, Sons, and Field. The floats of the paddle-wheels were reefed, in order to allow the engines to work at full speed at moorings, and indicator diagrams were taken, which showed that the performance of the condensers was quite satisfactory, and equal to what it had been before the vessel left this country. Owing to the defective state of the hull of the ship, the engines and boilers were taken out, and the latter were found in excellent condition —indeed, almost as perfect as when first put on board. The engineers reported that the condensers had given very little trouble, and on examination, they were found free from any defects. These, and other examples of surface condensation with which the writer had become acquainted, caused him to have great confidence in the system, and to desire to introduce it again at the earliest opportunity.

In 1859, having to design and construct a set of engines of 400 nominal horse power for the Peninsular and Oriental Co.'s new ship "Mooltan," with the view of trying what economy could be effected in the working of the machinery of their vessels, the writer determined to employ surface condensation; not expecting to realise any large amount of economy from this system alone, but believing that a great benefit would result from the increased durability of the boilers, and the saving of the time frequently lost in cleaning them, together with some economy of fuel, arising from the absence of the necessity of blowing out. The practice of blowing out is, indeed, frequently carried to excess; in one instance, known to the writer, at least four times the quantity of water necessary to keep the boilers clean was blown out; the expenditure of fuel being, consequently, most excessive.

The area of surface in the condensers of the "Mooltan," and also of the condensers now making by the writer for the Peninsular and Oriental Co.'s new ships "Mysore" and "Rangoon," of 400 nominal horse power, and in the boilers of all the three ships, is almost identical: the boilers contain 4800 square feet of heating surface in each ship, and the condensers of the "Mysore" and "Rangoon" contain 4712 square feet of condensing surface, and those of the "Mooltan" 4200 square feet. The indicated power of the "Mooltan," when tried officially, was

1734 horse power; hence the area of condensing surface per indicated horse power is rather less than 2½ square feet.

For convenience of manufacture and arrangement of these engines, the condenser of each is divided into two parts, each part being exhausted by its own air-pump, so that each pair of engines is provided with four air-pumps and four condensers. The air-pumps are 18 inches diameter, with a stroke of 3 feet. These dimensions being used by the writer with injection condensers in engines of the same nominal power, he believes they are larger than necessary for surface condensers of engines in good condition, with condensing water at the average temperature of the sea in this climate; but, as these engines are to be employed in the Indian seas, it was considered expedient to provide large air-pumps and large pumps for circulating the condensing water, so as to allow of almost any quantity of condensing water being driven through the condensers that may be found necessary in an Indian climate. The air-pumps discharge their water direct into the boilers, according to Hall's plan, so that no feed-pumps are necessary. The air which leaks into the engines is allowed to escape by an open stand-pipe, connected to the highest point of the feed-pipe, and carried up inside the mast, which is of iron, to a greater height than is due to the pressure of steam in the boilers. A valve, regulated by a float, was originally fitted to the "Mooltan," for allowing the escape of the air; but it was found to require some little attention, and hence the stand-pipe was substituted, which answers perfectly, without any attention.

Each condenser contains 1178 seamless drawn pure copper tubes, ⅝ inch outside diameter, and No. 18 wire-gauge, or ·050 inch thick, 5 feet 10 inches long, weighing 28 oz. each tube, and fixed at 1 inch pitch, centre to centre. The tube plates of the "Mooltan" are of cast gun-metal, ¾ inch thick; but those of the "Mysore" and "Rangoon" are of rolled copper, finished ¾ inch thick, one of which is exhibited. These are first set as flat as possible, and the tube holes marked out upon them. The holes are then drilled, under a common drilling machine, with a drill of two diameters, having a guard upon it, to fix the depth to which the larger diameter shall penetrate the plate. One machine, worked by an ordinary driller, drilled the 1178 holes in the tube plate exhibited in 70 hours. The tapping of the holes is then proceeded with, and is effected with a tap, having a parallel end to guide it, which fits the smaller diameter of the tube holes. One man, of ordinary skill, tapped the 1178 holes in the plate exhibited in 70 hours. After having been drilled and tapped, the tube plate is again set perfectly flat on a surface plate, and then both sides are faced off in a lathe or planing machine.

The screwed glands for securing the packing at the ends of the tubes are made from Muntz's metal solid-rolled tubes, which are obtained in lengths of about 5 feet, rolled to gauge both inside and outside: the inside diameter is exactly that of the outside of the copper tubes—namely, ⅝ inch—and the outside diameter is such that, when screwed, it will exactly fit the tapped holes in the tube plates. It is screwed on the outside, as it comes from the maker, in a common screwing machine, and is then cut by a circular saw into ½-inch lengths, to form the glands. The saw marks are taken off the ends by a facing cutter revolving in a lathe, and the same operation clears out the inside of the hole. The

notch for the screw-driver is cut by passing a number of the glands, when screwed into a plate, under a revolving circular saw of the required thickness. The packing is composed of linen tape: a piece of this tape, 12 inches long and $\frac{7}{16}$ inch wide, is wound round a mandril, the ends and edges being slightly stitched, in which state it is readily put into the tapped holes of the tube plate, and, when screwed down by the gland, forms a very perfect and lasting joint. The thickness of the tape is such that 1000 of these packings weigh about 2 lbs.

The exhaust steam from the engines passes down through the interior of the condenser tubes, and the sea water for keeping the tubes cold is driven up through the spaces between the tubes. The sea water is admitted through an inlet pipe, fitted with a slide valve, at the bottom of the ship, and enters the condensers at the bottom; it then circulates round the outsides of the tubes, and makes its exit through regulating valves at the top of the condensers, at about the load water line of the vessel. These valves answer the purpose of regulating the flow of sea water equally through the two divisions of the condenser, and also of shutting out the water from above, when the outsides of the condenser tubes have to be examined. The flow of water is produced by one of Appold's centrifugal pumps; the diameter of the revolving disc being 36 inches; it is driven by a pair of wood and iron spur wheels, the proportions of which are about 1 to 3½, so that, at the ordinary speed of the engines of the "Mooltan"—namely, 56 revolutions—the pump makes 194 revolutions per minute. Two of these pumps are provided; the second being driven by an auxiliary engine, to be used in case of the failure of the other.

The condensers constructed according to the proportions and mode of manufacture above described, and adopted by the writer, have been found quite efficient, and very durable. Indicator diagrams, taken from the "Mooltan," in a voyage in October of last year, were exhibited, to show the degree of exhaustion in the cylinders, which are 96 inches diameter and 3 feet stroke, the steam being exhausted into them from the high-pressure cylinders of 43 inches diameter and the same length of stroke: the boiler pressure was 17 lbs. per square inch. The engines were making 58 revolutions per minute, and the diagrams showed that the vacuum in the cylinders was sufficient to support a column of mercury 26 inches high, when the vacuum in the condensers was 28 inches of mercury.

The condensers of the "Mooltan" have now run 42,000 miles; and at the end of 30,000 miles—namely, in April last—the writer examined the inside and outside of the condenser tubes, and found the outsides perfectly clean; but inside there appeared a slight coating of grease, resulting from the lubricating material employed in the interior of the engines. This was, however, so slight as not to affect the action of the condensers; indeed, the vessel ran the last 300 miles of the 30,000 at an average speed of 60 revolutions per minute, with 24 lbs. of steam in the boilers, and the vacuum in the condensers supporting a column of mercury 27½ inches high. A very careful examination of the inside of the boilers showed that the action of the surface condensers, returning always pure water into them, is likely to ensure their continued efficiency, as there was no appearance of deterioration whatever. The lubricating material employed in the engines collects in the boilers, adhering to the

sides, and stays about the water line, and is to be found in large lumps in the bottom water space, below the furnaces; this requires to be taken out occasionally, otherwise, in the opinion of the engineer in charge, it causes the boilers to prime.

Before determining on adopting exactly Hall's mode of manufacture for the condensers, although his experience of it had been very favourable, the writer examined the other plans for surface condensation, in most of which the joints between the tubes and tube plates are made with vulcanised india-rubber; but having understood that a chemical action took place between the copper of the tubes and the sulphur employed in preparing the india-rubber, and not being able to discover in the new plans any advantage over Hall's condenser, he adhered to this construction in the condensers of the "Mooltan." As regards the action of the vulcanised india-rubber on the copper tubes, the writer placed a piece of copper tube inside a piece of vulcanised india-rubber tube, and carefully washed and weighed the copper tube every month, and found a gradual decrease in its weight.

In designing the engines of the "Mooltan," no provision was made for cleaning either the insides or the outsides of the tubes of the condensers, except that the connection between the condensers and cylinders was so arranged as to admit of the ready removal of the entire condenser case, with its tubes. Each condenser case is a rectangular vessel, about 2 feet 10 inches by 3 feet 6 inches, and 5 feet 10 inches high; and by removing the bolts in the joints at top and bottom, the entire condenser, with its tubes, can be drawn out clear of the cylinder, and the inside of the tubes can then be cleaned; the tube plates being in this case of gun-metal, cast with the edge thickened ½ inch all round on the outer face, so as to clear the projecting glands of the tube ends. The two condensers of one engine might be removed, the tubes cleaned, and the condensers refixed, in 40 hours; but, up to the present time, there is nothing in the state of the condensers to indicate the necessity of cleaning either the insides or outsides of the tubes; indeed, the outsides are cleaner and brighter than when the tubes were first fixed in their place. When it becomes necessary to clean the insides, it is recommended to apply a solution of caustic soda, by filling the condenser with it up to the top of the upper joint: this was also the practice followed by Hall, with success, in his condensers, in 1837. Indeed, Hall's condensers were employed in the "Penelope" for more than six years, and the engineer in charge during that period stated that, with the exception of occasionally cleaning out the insides of the tubes, by the application of a solution of soda and water, the condensers never gave an hour's trouble. The cost of a sufficient quantity of the solution to clean out the condensers of a 400-horse power engine would be about £5; and it is possible that it may be found desirable to perform this operation once a year.

The loss of water that occurs in the boilers, from leakage and other causes, is made good by an auxiliary boiler, the steam from which is passed through a small engine, which pumps the water for supplying the hydraulic apparatus employed in steering the ship and other purposes, whereby the coal consumed in the auxiliary boiler is utilised.

Mr. Humphrys showed some of the solid-drawn copper tubes used in the condensers, and one of the copper tube plates, containing 1178 holes at 1 inch pitch, drilled and tapped; also specimens of the screwed glands and tape packings, and of the tools used in making the holes of the tube plate, as described in the paper.

The Chairman inquired the reason of the failure of former attempts with Hall's condenser, and why it had gone out of use.

Mr. Humphrys did not consider there had been any failure in the former trials of Hall's condenser, but believed it had been really successful from the time when first tried, thirty years ago. The great prejudice, however, at the time against any change from injection condensers, had prevented the use of this surface condenser being persevered in; and objections had been raised to its use which the present experience had now fully proved were not attributable to the principle of the condenser.

Mr. J. F. Spencer observed that he had also been working for many years at surface condensation, but on the opposite system of pumping the cold water through the interior of the condenser tubes, and condensing the steam on the outside; and he was glad now to learn the practical results of the working of Hall's condenser in a large ship, as described in the paper, the merits of that condenser having certainly not been fully appreciated. He thought they were much indebted to Mr. Humphrys for having brought forward the subject, and for the valuable record of facts contained in the paper that had been read.

In making a comparison between the two plans of surface condensers—the one with the condensing water outside the tubes and the steam inside, and the other with the steam outside and the water passing through the inside of the tubes—it was not necessary to consider either the space occupied by the condenser or the mode of making the joints at the ends of the tubes, because the space occupied depended entirely on the size of tube employed, and the same size might be adopted whether the water passed through the tubes, or whether it passed outside; and the manner of making the joints, by means of packings and screwed glands, as described in the paper,—which was certainly a clever construction,—might be adopted for any plan of condenser. Setting these considerations aside, therefore, he considered an important practical difference between the two systems lay in the circumstance that, in order to examine a single tube of a condenser on the construction shown in the drawings, with the water outside the tubes, it was necessary to break a vacuum joint; and if such a joint were made again defectively at sea in a hurry, air would leak in, the vacuum in the condenser would be diminished, and the efficiency of working impaired: whereas, when the water was inside the tubes, all the ends of the tubes were accessible by simply breaking a water joint, which was a matter of little consequence; for if this joint were made defectively at sea, the only result would be a small outward leak of water out of the condenser, which would not affect the working of the engines in the slightest degree. In this respect, therefore, he thought a real practical advantage attended the plan of passing the water through the inside of the ubes.

A better distribution of the water through the condenser was also obtained by the same plan of passing it through the tubes instead of outside. In the condenser shown in the drawings, with the water outside the tubes, he thought it would be almost impossible to pass the

water thoroughly and equally over every portion of the condensing surface; whereas, with the water inside the tubes, by dividing the whole quantity of water into three or four currents, distributed equally throughout the condenser, and by proportioning the area of the tubes to that of the pump, the water might be driven over every portion of the condensing surface with almost complete uniformity. This he considered a very important point, and attributed to it much of the condensing power possessed by condensers having the water inside the tubes, with which he had obtained a condensation of 12 lbs. of water per hour per square foot of condensing surface, which he believed would be found greatly in excess of the general result; for judging of the efficiency of a condenser, the main point to be ascertained was the weight of water condensed per square foot of condensing surface per hour, in order to know how much heat had been abstracted from the steam per square foot of surface, without any regard to either the nominal or the indicated horse-power of the engine; and the condensation of 12 lbs. of water per square foot of surface per hour was the result he had obtained in work actually done in the "Sentinel," a vessel fitted with one of his surface condensers, having the water inside the tubes, and working on the east coast of England. He enquired what was the amount of condensation per hour per square foot of condensing surface in the "Mooltan."

Two vessels of 400 nominal horse-power had now been working nearly two years in the Canadian mail service, between Liverpool and Quebec—the "Hibernian" and the "Norwegian"—which he had fitted with the surface condensers having the water inside the tubes; and they made the voyage to Quebec and back, indicating 1200 horse-power, on a consumption in one voyage of 32 tons of coal per day. In this case, however, the expansion was very limited, and there were circumstances which prevented the economy from being carried out as would be wished; and in two other similar boats, of 400 nominal horse-power, now building for the same line, he hoped a better opportunity would be obtained for showing the advantages of surface condensers.

With reference to the use of vulcanized india-rubber for making the joints at the ends of the tubes, and its effect on the copper tubes, he had now upwards of 50,000 of these joints working, a great many of which had been working for several years; and out of that number there had been but three cases of deterioration of the copper tube from the action of the india-rubber, and in each of these cases the deterioration arose simply from defective fitting. Where there was a stream of hot salt water passing between the india-rubber and the copper tube, there corrosive action took place; but that was the result of defective workmanship. In all the rest of these joints not a single case of the kind had occurred. He had lately had some of the tubes removed that had been working in condensers sixteen or eighteen months, and there was not the slightest appearance of deterioration. It was important to have so complete an answer to any objection on that score, because india-rubber was a very convenient material to use for any kind of joint,—adapting itself, by its elasticity, to almost all conditions.

Mr. F. J. Bramwell enquired what was the degree of vacuum in the condenser at the time when the condensation of 12 lbs. of water per square foot of surface per hour was being obtained; because the amount of condensation varied with the vacuum that had to be maintained.

He enquired, also, what was the proportion between the condensing surface and the boiler surface.

Mr. J. F. Spencer replied that, in the "Sentinel," which he had referred to, of 100 nominal and 350 indicated horse power, the vacuum in the condenser was 25 inches of mercury at the time of condensing 12 lbs. of water per square foot of surface per hour. The boiler surface was 1750 square feet, and the condensing surface 850 square feet, or practically one-half of the boiler surface, which was the proportion he had generally adopted,—giving, in this case, 2½ square feet of condensing surface and 5 square feet of boiler surface per indicated horse-power. Sometimes he had employed rather less condensing surface; but in no case had he made it exceed 3 square feet per indicated horse-power, reckoning the boiler surface at about 6 square feet per indicated horse power, or about 22 square feet per nominal horse power. In the "Hibernian" and "Norwegian," the boiler surface was 6200 square feet, and the condensing surface 2700 square feet, being 5¼ and 2¼ square feet, respectively, per indicated horse-power.

With regard to the accumulation of grease in the condenser, that was one of the reasons why he preferred the plan of having the steam outside the tubes; for he believed it would be found that a condenser with the steam outside the tubes would last three times as long, with the same accumulation of grease, as one with the steam inside the tubes. It was evident that the accumulation would take place much more rapidly inside the tubes, and that the speed of passage of the steam would be much more retarded with each additional layer. He had had one condenser working about three years without any cleaning at all, the tubes being horizontal with the steam outside, and found that three-fourths of the condenser was perfectly free from grease, and the remainder had only a small portion on the upper side of the tubes, the lower side being perfectly clean. A practical conclusion, however, could not be drawn from one or two cases; for, at the first starting of a new plan, great care was taken to obtain a satisfactory result, by using no more grease in the engine than was absolutely necessary for lubrication. Grease might accumulate in the boilers and condensers, and would accumulate more rapidly, he thought, in Hall's condenser than in condensers with the steam outside the tubes.

The Chairman observed, that the proportion between the boiler surface and the condensing surface that had just been described was as two to one; whereas, the areas, in the case given in the paper, were 4800 square feet of heating surface and 4712 square feet of condensing surface, or practically the same.

Mr. Humphrys said, it must be borne in mind that, in this case, the 4800 square feet of heating surface in the boilers gave only 12 square feet per nominal horse power or 2¾ square feet per indicated horse power, instead of 6 square feet of boiler surface per indicated horse power, as had been mentioned; and a comparison could not be made between different cases without taking into account the proportion of boiler surface per horse power. As regarded the quantity of water condensed per square foot of condensing surface, no experiments had been made; but the proportion of the condensing surface to the indicated horse-power was 2½ square feet per indicated horse power.

Provisional Protections Granted.

[*Cases in which a Full Specification has been deposited.*]

2872. John Carpendale, of Sheffield, for improvements in the means of producing raised chasing on Britannia and other compressible metals.—[*Dated October 25th.*]

2935. George Haseltine, of Fleet-street, for improvements in horse-shoe machines,—being a communication.—[*Dated October 30th.*]

3061. Edward Samuel Ritchie, of Brookline, Massachusetts, U.S.A., for an invention having reference to the mariner's compass.—[*Dated November 13th.*]

[*Cases in which a Provisional Specification has been deposited.*]

1958. James McGeary, of Salem, Massachusets, U.S.A., for improvements in the manufacture of gas, and the apparatus to be employed for that purpose,—being partly a communication.—[*Dated July 7th.*]

1998. William Ashton, of Manchester, for certain improvements in machinery employed in the manufacture of "braids" and similar articles; parts of which improvements are also applicable to machinery used in spinning fibrous substances.—[*Dated July 11th.*]

2026. Oliver Perry Drake, of Massachusetts, U.S.A., for a new and useful or improved apparatus for vaporizing and aerating a liquid hydrocarbon to be burned for illumination or for other purposes.—[*Dated July 14th.*]

2035. Thomas Goulston Ghislin, of Hatton Garden, for improvements in the treatment or preparation of British and foreign algæ, and the application of the same to various branches of the arts and manufactures.—[*Dated July 15th.*]

2080. Auguste Fournier, of Maddox-street, for improvements in the manufacture of easy chairs, seats for railway and other carriages, and other kinds of seats and mattresses.—[*Dated July 22nd.*]

2110. Henry Alfred Jowett, of Sawley, Derbyshire, for improvements in obtaining motive power, and in transmitting the same from place to place, and in apparatus connected therewith.—[*Dated July 25th.*]

2167. William Norman, of Manchester, for improvements in tables and drawers, or other sliding receptacles.—[*Dated July 30th.*]

2186. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in projectiles for ordnance and small arms, and in the wads or sabots to be used therewith,—being a commuuication.—[*Dated August 1st.*]

2220. Jean Sirou, of Castel Sarrazin, Tarn et Garonne, France, for a new medicinal preparation for internal and external application.—[*Dated August 8th.*]

2311. Samuel Alexander Bell, of Stratford, and Thomas Higgins, of Bow, for improved apparatus for dipping lucifer matches.—[*Dated August 16th.*]

2355. François Théophile Moison, of Paris, for improvements in the process of cleaning organic matter.—[*Dated August 23rd.*]

2373. John Ambrose Coffey, of Providence-row, Finsbury-square, and Theophilus Redwood, of Montague-street, Russell-square, for improvements in the manufacture of salts of ammonia, and other products from the ammoniacal liquors of gas works and animal charcoal works, and in the still or apparatus to be used in such manufacture.—[*Dated August 27th.*]

2409. William Edward Gedge, of Wellington-street, Strand, for improvements in machinery or apparatus for manufacturing velvet,—being a communication.—[*Dated August 30th.*]

2467. William Antil Richards, of Cornwall-place, Holloway, for an improved fastening for purses, pocket books, bags, cigar cases, books, wearing apparel, jewellery, and other articles.—[*Dated September 6th.*]

2500. John Hemsley, of Melbourne,

Derbyshire, for an improved fabric or material for scarfs, ties, handkerchiefs, and neckerchiefs.—[*Dated September* 11*th.*]

2542. William Clark, of Chancery-lane, for improvements in the treatment of peat and peat tar, for the production or manufacture of various products, and in apparatus for the same,—being a communication.—[*Dated September* 16*th.*]

2556. Ludwig Mond, of Hesse Cassel, for an improved method of obtaining hypo-nitric acid and nitric acid from nitrate of soda.—[*Dated September* 18*th.*]

2571. Johan Bernhard Giertz, of Great Saint Helens, for improvements in gas burners or jets.

2574. John Imray, of Bridge-road, Lambeth, for improvements in apparatus for telegraphing and signalling by means of electricity,—being a communication.

The above bear date September 19*th.*

2588. James Long, of Gorleston, Great Yarmouth, for an improved machine for cleansing and scraping streets, roads, or ways.—[*Dated September* 22*nd.*]

2591. James Mapple, of Newman's-place, Kentish Town, and Daniel Mapple, of Queen's-road, Homerton, for improvements in telegraphic apparatus.—[*Dated September* 23*rd.*]

2611. Robert Alexander, of Islington, Liverpool, for improvements in mariners' compasses.—[*Dated September* 25*th.*]

2629. William Edward Gedge, of Wellington-street, Strand, for improvements in the construction of leaden window sashes, casements, or glazed coverings or partitions,—being a communication.—[*Dated September* 26*th.*]

2634. Michael Henry, of Fleet-street, for certain new and improved applications of petroleum and its products, certain agents produced by combining the same with other substances, and certain modes of treating caoutchouc, gutta-percha, and their compounds, and substances similar thereto,—being a communication.—[*Dated September* 27*th.*]

2654. Alexander Prince, of Charing-cross, for improvements in the manufacture of varnish, printing ink, paint, and printing colors,—being a communication.—[*Dated September* 30*th.*]

2660. Edward Lord, of Rawtenstall, Lancashire, for an improvement in power looms for weaving.—[*Dated October* 1*st.*]

2663. William Henry Ward, of Auburn, New York, for improvements in night, day, and fog signals, and the means of effecting the same.—[*Dated October* 2*nd.*]

2672. William Clark, of Chancery-lane, for improved atmospheric toy pistols and guns,—being a communication.—[*Dated October* 3*rd.*]

2684. Joseph Martin Cabirol, of Paris, for a new or improved submarine lamp.

2688. William Clark, of Chancery-lane, for improvements in the means of preserving goods from fire, and in apparatus for the same,—being a communication.

The above bear date October 4*th.*

2693. Thomas Keech, of New York, for improvements in floating batteries,—being a communication.

2694. John Bradbury, of Pendleton, and William Bradbury, of Oldham, for certain improvements in carding engines.

2695. Daniel Lowe, of Aston, near Birmingham, for improvements in the manufacture of door bolts and latches.

2696. Samuel Holland, of Oldbury, Worcestershire, for improvements in machinery for the manufacture of bricks, drain, sanitary, and other pipes, tiles, quarries, and other articles of like manufacture, made from clay, marl, and other plastic substances.

2697. William Clark, of Chancery-lane, for improvements in articles of clothing,—being a communication.

2698. James Newman, of Crayford, Kent, for improvements in apparatus for crystallizing and for evaporating.

2699. Thomas Beards, of Stowe, for improvements in machinery for cultivating land.

2700. Stephen Fitchew Cox, of Bristol, for improvements in washing and tanning hides and skins.

2701. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improved apparatus for drying grain,—being a communication.

2702. Charles Chinnock, of Brooklyn, New York, U.S.A., for improvements in the construction of axle-boxes.

The above bear date October 6th.

2703. Joshua Heap, of Ashton-under-Lyne, for improvements in screw stocks and dies.

2704. Joseph Smith, of Egdon, near Worcester, for an improved screw linch-pin for carriages and agricultural implements.

2705. William Aston, of Birmingham, for certain improvements in the manufacture of buttons for ladies' and gentlemen's wear.

2706. James Oxley, of Frome, Somersetshire, for improvements in apparatus for expressing and separating beer from yeast or barm.

2707. Ferdinand Rahles, of Albert-street, for an improved safety envelope.

2708. Alexander Forbes, of Aberdeen, for improvements in connecting together parts of vessels formed of tin plate, and in the means or apparatus employed therein.

2709. John Davis Welch and Alfred Phippin Welch, both of Gutter-lane, for improvements in machinery for blocking and pressing hats and bonnets.

2710. Henry Duncan Preston Cunningham, of Bury House, near Gosport, for improvements in working the guns, and in performing other necessary work on board ships, and in apparatus employed therein.

2711. Joseph Kaye Hampshire, of Whittington, Derbyshire, for improvements in apparatus or machinery for washing coal, coal slack, and other mineral substances, and separating foreign particles therefrom.

2712. John Beale, of Maidstone, and Mary Ann Beale, of Upper Brunswick-terrace, Barnsbury, for improvements in the preparation or manufacture of manure.

2713. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the construction of condensers or coolers, —being a communication.

The above bear date October 7th.

2714. Charles Frederick Terry, of Sheffield, for improvements in machinery for propelling vessels.

2715. Daniel Nickols, of Manchester, for improvements in machinery or apparatus for measuring and registering lace and other similar articles.

2716. William Chesterton Burden, of Leicester, for improvements in mechanism for giving the pitch or tone required in tuning musical instruments, and also the key note of vocal music.

2717. Thomas Ratcliffe, of Colne, Lancashire, for certain improvements in looms for weaving.

2718. Pierre Clavel, of Paris, for improvements in the treatment of violet colors derived from coal tar oils.

2719. John Reeves Harris, of Goldington-crescent, Saint Pancras-road, for improvements in propelling vessels.

The above bear date October 8th.

2721. Hugo Dullens, of Little Britain, for an improved runner and fastening for umbrellas, parasols, sunshades, and other like articles.

2722. Joseph Maurice, of Langham-place, for improvements in steering ships or vessels, and in the apparatus to be employed for that purpose.

2723. William Bush, of Tower-hill, for improvements in cannon and small arms.

2724. Christopher Naylor Wilson, of Batley Carr, near Dewsbury, for improvements in rag machines.

2725. John Henry Johnson, of Lincoln's-inn-fields, for improvements in polishing precious and other hard stones, and in the machinery or apparatus employed therein,—being a communication.

2726. John Henry Johnson, of Lincoln's-inn-fields, for improvements

in the manufacture of paints or pigments,—being a communication.

2727. Robert Hammond, of Trafalgar-square, for improvements in armour for ships of war.

2728. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improved machinery for breaking and cleaning flax, hemp, and other like fibrous substances,—being a communication.

2729. Joseph Bence Palser, of Holborn, for improved apparatus for manufacturing paper pulp, and recovering the alkali used in such manufacture.

2730. Gustave-Simons, of Liege, for improvements in the manufacture of plates, rods, axles, tyres, and other articles that are required to be partly of iron and partly of steel.

The above bear date October 9th.

2731. Louis Hosch, of Laurence Pountney-hill, for an improvement in the mode of constructing travelling trunks and portmanteaus.

2732. William Schofield and Silas Schofield, both of Ashton-under-Lyne, for improvements in apparatus for cutting button holes and other similar purposes.

2733. Robert Ellis Green and John Cockcroft, both of Accrington, for an improved amalgamation of materials forming a substance suitable for printers' blankets, conductors used in paper making, packings for joints, and similar purposes.

2734. George Baguley, of Hanley, and Henry Greener, of Sunderland, for an improved construction of insulator, for telegraph wires.

2735. James Lowe, of Claremont-place, Old Kent-road, and Josiah Harris, of Newton Abbott, for an improved construction of propeller.

2736. Hippolyte Auguste Marinoni, of Paris, for improvements in apparatus for fixing type in the chases.

2737. William Charles Edge, of Clerkenwell, for improvements in velocipedes.

2738. Douglas Symonds Sutherland, of Rio de Janeiro, for improvements in constructing beams, girders, bridges, and viaducts.

2739. William Weallens, of Newcastle-upon-Tyne, for improvements in surface condensers for marine and other engines.

2740. Thomas Anderson, of Glasgow, for improvements in the construction of ships or vessels.

The above bear date October 10th.

2741. James John Shedlock, of Cambridge-street, Pimlico, for improvements in gas meters.

2742. Edmund John Franklin, of Birmingham, for a combined spring tape measure, needle case, and pincushion.

2743. Augustine Vennedy, of Swan-yard, Shoreditch, for an improved composition for covering and forming the tips of umbrellas and parasols; also applicable to covering the ribs and stretchers of same.

2744. Richard Archibald Brooman, of Fleet-street, for improvements in breech-loading fire-arms,—being a communication.

2745. William Catchpool, of Goswell-road, for improvements in fire-escapes.

2746. James Durrant, of Stangate-street, Westminster, for improvements in the form and construction of chimney tops or appliances for surmounting chimneys.

2747. Thomas Bouch, of Edinburgh, for improvements in machinery or apparatus for charging or filling cartridges.

2748. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improvements in evaporating apparatus, applicable for the manufacture of sugar,—being a communication.

2749. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improvements in sewing machines,—being a communication.

The above bear date October 11th.

2750. Samuel Chatwood, of Bolton, for improvements in, and connected with, fire and thief proof depositories, and locks or fasteners connected therewith; parts of which improvements are also applicable to other purposes of security.

2751. George Harvey and Alexander Harvey, junior, both of Glasgow,

for improvements in boring machinery.

2752. August Friedrich Gallis, of Dean-street, Soho, for a new method of covering street omnibuses and vehicles of every description, for the purpose of sheltering passengers travelling on the top of the same.

2753. George Haseltine, of Fleet-street, for improvements in "jacks" and screw-nuts for attaching thills and poles of waggons and other vehicles to the axletrees of the same,—being a communication.

2754. Charles McCarthy, of New York, for improvements in automatic safety valves.

2755. William Loeder, of New Broad-street, for an improved projectile to be used with ordnance or firearms of any calibre,—being a communication.

2756. Charles Thomas, of Bristol, for improvements in the manufacture of silicate of soda or silicate of potash, and in the manufacture of artificial stone.

2757. William Gillum Haig, of Canonbury-park North, for a new article of apparel to be worn instead of, or in addition to, a shirt front and waistcoat.

2758. Joseph Gumbley, of Lantrissant, Glamorganshire, for an improved break for vehicles travelling on common roads.

2759. Arthur Irvin Mahon, of Rathmines, Dublin County, for improvements in propellers and paddle floats, also applicable to the raising and forcing of water or other fluids.

2760. Edward Brown Wilson, of Parliament-street, for improvements in apparatus employed in the manufacture of iron and steel.

The above bear date October 13th.

2761. Spencer Smith, of High Holborn, for improvements in kettles, saucepans, and boilers, for domestic and other purposes.

2762. Frederic Groom Grice, of West Bromwich, for an improvement or improvements in the manufacture of nuts for screwed bolts, and in machinery to be employed in the said manufacture.

2763. Edmund Suckow and Edward Habel, both of Manchester, for certain improvements in machinery or apparatus for preparing, spinning, and doubling cotton and other fibrous materials.

2764. Henry Bridson and John Alcock, both of Bolton-le-Moors, for improvements in machinery for folding, measuring, and hooking woven fabrics.

2765. Edward Barlow, James Clough, and Francis Hamilton, all of Bolton-le-Moors, for certain improvements in machinery for driving cotton gins, and for preparing and combing cotton and other fibrous substances.

2766. Jacob Snider, jun., of Pennsylvania, U.S.A., for improvements in the construction of "Hansom cabs," and other similar vehicles.

2767. Charles Harratt, of Hornsey-lane, Highgate, for improvements in ships' masts.

2768. David Reid and Christian John Reid, both of Newcastle-upon-Tyne, for improvements in the manufacture of cases for watches and other pocket timekeepers.

2769. Matthew Cartwright, of Hoxton, for improvements in plates for artificial teeth.

2770. Richard Archibald Brooman, of Fleet-street, for improvements in apparatus for carburetting gas,—being a communication.

2771. Richard Archibald Brooman, of Fleet-street, for improvements in dressing millstones and in materials employed therein,—being a communication.

2772. Edward Henry Cradock Monckton, of Thurloe-place, South Kensington, for improvements in coils of induction, and in obtaining and applying power by means of electro-magnetism.

2773. Owen Johnson Showell and John Showell, both of Manchester, for improvements in the construction of glass roofs and roof lights."

2775. John Henry Johnson, of Lincoln's-inn-fields, for improvements in sewing machines,—being a communication.

The above bear date October 14th.

2776. Echlin Molyneux, jun., of Leavien, Enniskerry, County Wicklow,

Ireland, for an improved carriage, with a travelling railway attached.

2778. John Henry Jenkinson, of Manchester, for certain improvements in drinking fountains.

2779. Jacob Taylor, of Oldham, for improvements in temples for looms.

2781. Charles de Bergue, of Manchester, for improvements in the permanent way of railways.

2782. William Pope, of Cornwall-road, Lambeth, for improvements in coating the sides of ships, batteries, forts, or other places, with defensive armour plates.

2783. Pasquale Potenza, of Naples, for the extraction, preparation, and spinning of the silky fibre contained in the bark of mulberry trees, and the manufacture of the same into textile fabrics.

2784. Jean Baptiste Gabriel Marie Frédéric Piret, of Paris, for improvements in lubricating apparatus.

2785. François Ferdinand Prud'homme, of Paris, for improvements in machinery or apparatus for raising water.

2786. John Bapty, of Leeds, for improvements in apparatus for preparing wool and other fibrous materials.

2787. Richard Archibald Brooman, of Fleet-street, for improvements in felting machines; applicable also to the fulling, scouring, and dressing of pure and mixed woollen stuffs,—being a communication.

2789. Edward Alfred Cowper, of Great George-street, Westminster, for improvments in steam engines.

The above bear date October 15*th.*

2790. William Barningham, of the Pendleton Iron Works, near Manchester, for improvements in the permanent way of railways.

2792. Godfrey Thomas Hope Pattison, of Glasgow, for improvements in machinery or apparatus for embossing or finishing woven fabrics.

2793. Godfrey Thomas Hope Pattison, of Glasgow, for imparting an improved surface or appearance to fabrics woven with mixed materials.

2794. Henri Amable Rèmiére, of Paris, for an improved horse collar.

2795. Florentin Delmas, of Cloak-lane, for a rain absorber.

2796. Thomas George Harold, of Brooklyn, New York, for improvements in locks.

2797. Edward Humphrys, of Deptford, for improvements in steering apparatus.

2798. Henry Ransford, of Huron Lodge, West Brompton, for improvements in building ships and other vessels.

2799. John Cash and Joseph Cash the younger, both of Coventry, for an improvement in the manufacture of valentines.

2800. Joseph Robinson, of East India-road, for improvements in protecting the submerged portions of iron ships, and in ventilating the cabins and cabin decks in iron ships.

2801. Edward Hely, jun., of Dublin, for improvements in envelopes.

2802. Edward Nelson, of Johnson's-place, Ranelagh-road, for improvements in the manufacture of apparatus for heating and super-heating steam and air without decomposition.

The above bear date October 16*th.*

2805. Jonah Davies and George Davies, both of Tipton, for improvements in rotary engines, rotary pumps, and rotary blowing machines.

2806. William Sadler Kennedy, of Queen's-road, Bayswater, for an improved method of, and apparatus for, applying fomentations and other external remedies to the throat.

2807. George Tomlinson Bousfield, of Loughborough-park, Brixton, for improvements in the manufacture of iron and steel,—being a communication.

2808. John Henry Johnson, of Lincoln's-inn-fields, for improvements in the prevention or removal of incrustation in or from steam generators,—being a communication.

The above bear date October 17*th.*

2809. Richard Webster, of Leeds, for improvements in means or apparatus for preventing or mitigating accidents arising from collisions of railway trains.

2810. Edward Lord, of Todmorden,

for certain improvements in machinery for opening and cleaning cotton and other fibrous substances.

2811. Henry Ledger and Benjamin Williamson, both of Manchester, for an improved substitute for tombstones, tablets, monuments, and other similar memorials or commemorative records.

2812. John Bentley, of Denton, Lancashire, for improvements in apparatus for forming and pressing felt hats.

2813. Bernard Lauth, of Reichshoffen, France, for improvements in machinery or apparatus for polishing sheet iron or other metal.

2814. Richard Archibald Brooman, of Fleet-street, for improvements in frames for doubling and twisting threads,—being a communication.

2815. John Fuller, of Bishopsgate-street, for an improvement in treating india-rubber used on a wire or wires for insulating the same.

2817. William Clark, of Chancery-lane, for improvements in apparatus for dredging,—being a communication.

The above bear date October 18th.

2818. James Tangye, of Birmingham, for improvements in, or additions to, certain kinds of pulleys for raising heavy weights.

2819. George Haseltine, of Fleet-street, for improvements in forging cannon and other heavy articles,—being a communication.

2820. Richard Archibald Brooman, of Fleet-street, for improvements in transferring designs and prints produced by photography to stone or zinc,—being a communication.

2821. John Clark, of Glasgow, for improvements in the means of applying railway brakes.

2822. Nathaniel Richard Hall, of Rosherville, Northfleet, and Michael Leopold Parnell, of the Strand, for improvements in the construction of thermometers.

2823. William Allen Turner, of Lawrence Pountney-lane, and Thomas Townsend Coughin, of King's-place, Stone's-end, for improvements in apparatus for measuring cloths and other fabrics; parts of which are also applicable to indicating distances travelled by vehicles.

2824. John Bellamy Payne, of Chard, for improvements in machinery for the spinning, twisting, and doubling and laying of hemp, flax, and other fibrous substances.

2825. Horace Leeman Emery, of Albany, U.S.A., for improvements in propelling machinery actuated by the application of animal power.

2826. John Henry Johnson, of Lincoln's-inn-fields, for improvements in apparatus for boiling liquids, and cooking or preparing food; applicable also as a night light,—being a communication.

The above bear date October 20th.

2828. William Tristram, of Bolton, Lancashire, for an improved method of, and apparatus for, preparing and dressing yarns or threads to be employed as warps.

2829. Walter Henry Tucker, of Fleet-street, for improvements in self-closing apparatus for doors.

2830. Joseph Byram, of Moldgreen, near Huddersfield, for improvements in lamps for the combustion of paraffin, rock oil, or other oils.

2831. Samuel Whitham and Thomas Wright, both of Wakefield, Yorkshire, for improvements in the manufacture of iron and steel, and in the apparatus employed for that purpose.

2832. Charles George Clarke the younger, of Owthorn, near Hull, for improvements in garden shears.

2833. Charles Clark, of the City-road, for improvements in cigar tubes, and in cigar and pipe mouth pieces.

2834. John Thomas Cooke, of Leicester, for improvements in battens for weaving.

2835. Richard Archibald Brooman, of Fleet-street, for improvements in waterproofing, and in recovering products employed therein,—being a communication.

2836. George Tomlinson Bousfield, of Loughborough-park, Brixton, for improvements in the manufacture of boots and shoes,—being a communication.

2837. Joseph Duke and John Cleaver, both of Puriton, Somersetshire, for

improvements in the manufacture of cement.

2838. George Haseltine, of Fleet-street, for improvements in the mode of, and in machinery for, manufacturing nails, brads, and other similar articles,—being a communication.

2839. Frederick Tolhausen, of Paris, for an improved machine for raising, lowering, removing, and carrying buildings, monuments, and ships or vessels,—being a communication.

2840. Cooper Tress, of Blackfriars-road, and François Cyrille Belhomme, of New-street, Covent-garden, for improvements in hats, caps, bonnets, and other coverings for the head.

The above bear date October 21st.

2841. George Clark, of Craven-street, Strand, for improvements in the construction, protection, and armament of ships, vessels, and floating batteries; some of which improvements are applicable to land batteries and forts.

2842. James Spence, of Her Majesty's Dock-yard, Portsmouth, for improvements in non-conducting compositions for preventing the radiation or transmission of heat or cold, and in coating metallic and other surfaces therewith.

2844. Enoch Fielding, of Willow Bank, near Todmorden, for improvements in the manufacture of healds, and in the machinery employed therein.

2845. Henry Wilde, of Manchester, for improvements in electro-magnetic telegraphs.

2846. Henry Herman Kromschroeder and John Frederick Gustav Kromschroeder, both of Princess-terrace, Regent's-park, for improvements in the manufacture of gas meters, and in the manufacture of sheet metal suitable for gas meters.

2847. Ebenezer William Hughes, of Great George-street, Westminster, for improvements in turn tables and turn bridges.

2848. Thomas Fearn, of Birmingham, for improvements in the manufacture of rods, poles, tubes, and other forms employed in the construction of various articles of furniture, and for other similar purposes.

2849. Thomas Greenwood, of Leeds, for improvements in machinery for preparing to be spun, flax, hemp, tow, silk waste, China grass, and other fibrous substances.

2850. Valentine Orlowski, of Worcester, for improvements in motive-power carriages.

The above bear date October 22nd.

2852. William Sutton Gamble, of Frederick-street, Caledonian-road, for an improved salinometer.

2853. Alexander Chaplin and George Russell, both of Glasgow, for improvements in obtaining fresh water by evaporation, and in apparatus therefor.

2854. John Turnbull, of Barnard Castle, Durham, for improvements in mills for grinding grain.

2856. Edward Bath, of Swansea, for improvements in treating alkali waste, to obtain sulphur therefrom.

2857. Matilda Cartwright Aston Perkes, of Dulwich, for an equilibrium double-action revolving rudder, self-balancing drag, and improved steering gear, —being a communication.

2858. Harry Rée, of Hamburgh, for improvements in apparatus for exercising the human body.

2859. Hugh Donald, of Johnstone, Renfrewshire, N.B., for improvements in machinery or apparatus for bending or straightening metal plates.

2860. Edward Hamer Carbutt and George Alfred Clough, both of Bradford, Yorkshire, for improvements in power hammers.

2861. Joshua Field, of Lambeth, for improvements in steam engines, condensers, and boilers.

2862. Richard Archibald Brooman, of Fleet-street, for improvements in tanning,—being a communication.

The above bear date October 23rd.

2863. Anne Jean Ferdinand Vigneulle-Brepson, of Paris, for a siphoidal cistern, with water reservoir, for kitchen or other drains in communication with infected sewers.

2864. Carl Christian Burmeister and William Wain, both of Copenhagen, for improvements in the construc-

tion of cupolas, and in apparatus connected therewith, for naval or other war purposes.

2865. Louis Groux, of Woodhouse, near Sheffield, for improvements in the manufacture of soap, and in machinery for that purpose.

2866. Josiah Gimson and Robert Flude, both of Leicester, for improvements in looms for weaving narrow fabrics.

2867. John Richard Nicholl, of Streatham, for an improved construction of fire-place or stove grate.

2870. Patrick Sarsfield Devlan, of Jersey City, New Jersey, U.S.A., for improvements in the manufacture of bearings, steps, axle boxes, and other surfaces and appliances, or articles subjected to friction.

The above bear date October 24th.

2873. William Owen, of Rotherham, for improvements in stoves.

2875. David Brown and William Brown, both of Smethwick, for improvements in rolling machinery for rolling gun barrels, cannons, and other articles.

2876. Joseph Alfred Nicholson, of Gracechurch-street, for improvements in lead, crayon, and other pencils.

2877. William Clark, of Chancery-lane, for an improvement in the construction of the joints of cast-iron gas and water mains and other pipes,—being a communication.

2878. Andrew Clark, of Brighton, for improvements in the construction of bows and pendants of watches.

2879. Pierre Alfraise, of Paris, for improvements in sewing machines.

2880. Thomas Goulston Ghislin, of Hatton-garden, for improvements in the treatment and utilization of certain foreign plants, for the obtaining of useful fibres therefrom.

2881. Enrico Angelo Ludovico Negretti and Joseph Warren Zambra, both of Hatton-garden, for improved apparatus for ascertaining or testing the explosibility of liquid hydrocarbons,—being a communication.

2882. John Peter Bourquin, of Newman-street, Oxford-street, for an improved manufacture of mount for photographic and other albums, miniatures, and other pictures.

The above bear date October 25th.

2883. Joseph Chattwood, of Bury, Lancashire, for improvements in ventilating rooms and cellars.

2884. John Henry Johnson, of Lincoln's-inn-fields, for improvements in rotatory engines,—being a communication.

2885. John Henry Johnson, of Lincoln's-inn-fields, for improvements in heating glass furnaces,—being a communication.

2887. Frederick Lipscombe, of the Strand, for improvements in purifying water.

2888. William James Williams, of Dorset-street, Salisbury-square, for improvements in the construction of field rakes for agricultural purposes,—being partly a communication.

2890. Frederic Ludovicus Henri William Bünger, of Gloucester-place, Brixton-road, for improvements in self-acting apparatus for discharging the water resulting from the condensation of steam,—being a communication.

2891. John James Ridge, of Thomas-street, Southwark, for improvements in treating certain farinaceous substances applicable to infants' or invalids' food, and in apparatus to be employed therein.

2892. Paul Emile Placet, of Paris, for an improved process of engraving.

2894. Alfred Peek, of Manchester, for improvements in apparatus for evaporating saccharine and saline solutions.

2895. Thomas Richardson, of Newcastle-upon-Tyne, for improvements in the manufacture of sulphate of soda.

2896. John Howie, of Hurlford, Ayrshire, N.B., for improvement in machinery or apparatus for regulating the supply of solid or liquid bodies to mills, or other apparatus used in mixing or preparing plastic matters.

The above bear date October 27th.

2897. James Chalmers, of Knight's-place, Wandsworth-road, for improvements in armour-plating ships of war and fortifications.

2898. Edward Hooper, of Southampton, for improvements in roofing tiles.
2900. Edmund Tatham and Amos Tatham, both of Ilkeston, Derbyshire, for an improvement in warp machines for the manufacture of looped fabrics.
2901. Horatio Allen, of St. James-place, St. James-street, for improved apparatus for preparing leaves and stalks of plants for being cleaned or dressed, for the purpose of obtaining the useful fibres they contain.
2902. George Hedgcombe Smith, of North Perrott, Somersetshire, for improvements in the manufacture of crinoline, or elastic hoops for dresses.
2903. Edward Scripps Tudor, of Upper Thames-street, for improvements in the purification of lead.
2905. Julius Jeffrys, of Hoddesden, Herts, for improvements in constructing surface condensers and apparatus for heating and cooling fluids.
2906. Thomas Sutton, of Saint Brelades Bay, Jersey, for improvements in preparing albumenized paper for photographic purposes.

The above bear date October 28th.

2907. Abraham Ripley, of Brook-street, Lambeth, for improvements in the construction of pistons for steam engines; which improvements are also applicable to air and liquid pumps.
2908. Andrew Shanks and Ferdinand Kohn, both of Robert-street, Adelphi, for improvements in hydrostatic presses.
2909. George Darlington, of Minera, Denbighshire, for improvements in the manufacture of zinc oxide.
2910. Alfred Krupp, of Essen, Prussia, for certain improvements in breech-loading ordnance and fire-arms.
2911. Adam Hogg, of Londonderry, for improvements in smoothing-irons.
2913. William Clark, of Chancery-lane, for improvements in the treatment of copper ores, and in apparatus for the same,—being a communication.
2914. Ishmael William Lister, James Bottomley, and William Bottomley, all of Rochdale, for improvements in looms for weaving.
2915. William Cooke, of Spring-gardens, for improvements in apparatus for ventilating.
2916. Wardle Eastland Evans, of Newton-terrace, Bayswater, for improvements in apparatus for playing organs, harmoniums, pianos, and other similar keyed instruments; and also improvements in reed musical instruments.
2917. William Edward Gedge, of Wellington-street, for improved apparatus in connection with the pans of waterclosets,—being a communication.
2918. William Edward Gedge, of Wellington-street, Strand, for improvements in looms for weaving,—being a communication.
2919. Daniel Fryer, of Carlton-square, Old Kent-road, and Joseph William Meears, of Annett's-crescent, Islington, for improvements in casks, tanks, or other receptacles for containing petroleum and other oils or spirits.
2920. Jeremiah Head, of New Swindon, Wiltshire, for improvements in machinery employed when cultivating land by steam power.
2921. John Unsworth, of Manchester, for improvements in steam engines.
2922. Frederick Luke Stott, of Rochdale, for improvements applicable to mechanism or apparatus for warping yarns or threads.
2923. Henry Paul Fryer Newham, of Nottingham, for improvements in the manufacture or production of reversible shawls.
2924. John Fletcher, sen., of Leeds, and John Fletcher, jun., of Newcastle-on-Tyne, for improvements in forming wrought-iron wheels, and in the tools and apparatus for making the same.

The above bear date October 29th.

2925. John Lockwood, of Batley, Yorkshire, for improvements in boilers.
2927. Francis Gregory, of Manchester, for improvements in presses for pressing seeds, fruits, hops, and other substances.
2928. George Mayall, jun., of Liverpool, and John Hollingworth, of Micklehurst, Cheshire, for certain

improvements in machinery or apparatus for preparing cotton and other fibrous materials for spinning.

2929. John Eaton, of King's Norton, Worcestershire, for an improvement or improvements in the manufacture of certain kinds of gas burners for illuminating purposes.

2930. George Piggott, of Birmingham, for new or improved machinery for punching, shearing, and rivetting sheets or plates of iron and other metals and alloys.

2931. Paul Giffard, of Paris, for improvements in air-guns and other air-arms.

2932. Joshua Horton, of Smethwick, near Birmingham, for improvements in the construction of armour-plated ships and fortifications.

2933. James Birch, of New Norfolk-street, for improved apparatus for unstopping or clearing from obstructions, drains, waterclosets, stack, water, and other pipes.

2934. Alexander Guild, of Horbury-gardens, Notting-hill, for improved apparatus for preparing and treating the leaves and stalks of fibre-yielding plants, and for cleaning and dressing the same.

The above bear date October 30*th.*

2936. William Astrop, of Jubilee-street, Stepney, for improvements in the manufacture of paper.

2937. William Renwick Bowditch, of Wakefield, Yorkshire, for improvements in carburetting or naphthalizing gas, and in the apparatus employed therein.

2938. Henry Lee Corlett, of Inchicore, Dublin, for improvements in the construction of tuyeres.

2939. George Dickinson, and Edward Cooke, both of Smethwick, for improvements in the construction and ornamentation of metallic bedsteads, couches, and children's cots.

2940. Daniel Spink, of Spaxton, near Bridgewater, for improvements in the method of propelling ships and other vessels.

2941. Alfred Andrews, of Birmingham, for an improved tool for cutting and rasping pegs in boots and shoes.

2942. Charles Gubbins, of York-place, Portman-square, for improvements in irons for ironing.

2943. George Hargrave Morgan, of Hereford, for improved mechanical arrangements for raising and lowering bodies.

2944. Henry Thompson, of Buckden, Huntingdonshire, for improvements in railway signals.

2945. Marie Celeste de Casteras Sinibaldi, of Greenwich, for improvements in the manufacture of armour plates for ships, fortifications and forts, and in the manufacture of plates to be used in the construction and building of ships, and for attaching copper or other like protective metal to the outside of metal plates, for making copper bottoms, or bottoms with a similar protection to iron ships, and for other purposes.

2946. George Speight, of Saint John-street-road, Clerkenwell, for an improvement in the manufacture of collars for men's wear.

2949. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improvements applicable to the carriages and beds of guns, mortars, and other ordnance,—being a communication.

2951. James Garth Marshall, of Leeds, for improvements in the treatment of the straw of flax, hemp, and other similar vegetable substances, preparatory to spinning the fibre thereof.

2952. William Jenkins, of Troedy Rhiw, Merthyr Tydvil, for an improved mode of, and apparatus for, cutting coal.

2953. James John Anderton, of Northampton, for a new or improved mode and means for the production of leather from waste leather scraps, and also for producing from such waste leather scraps in combination with india-rubber, gutta-percha, or other like substance, a new material to be used as leather, and for other purposes.

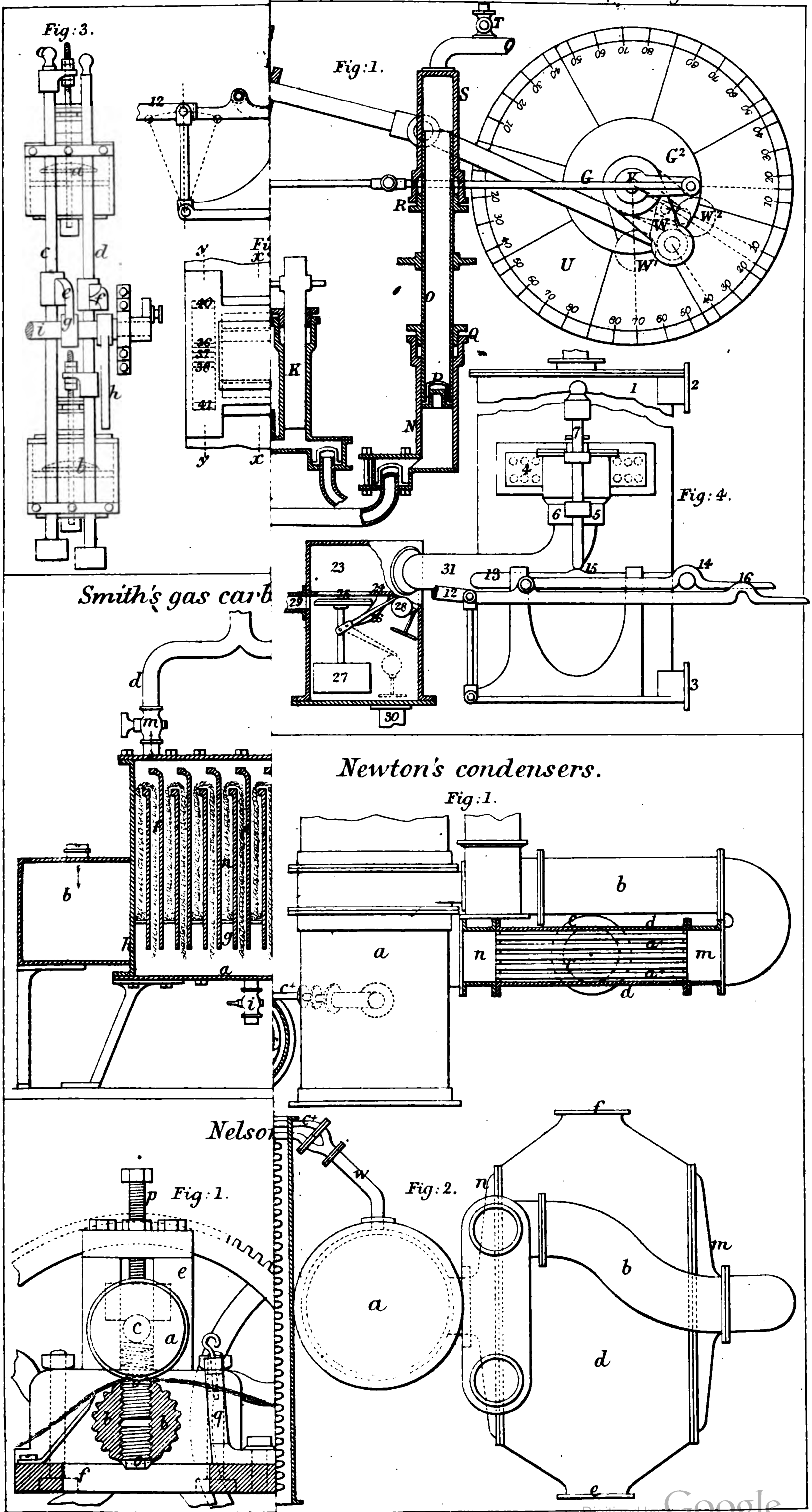
The above bear date October 31*st.*

New Patents Sealed.

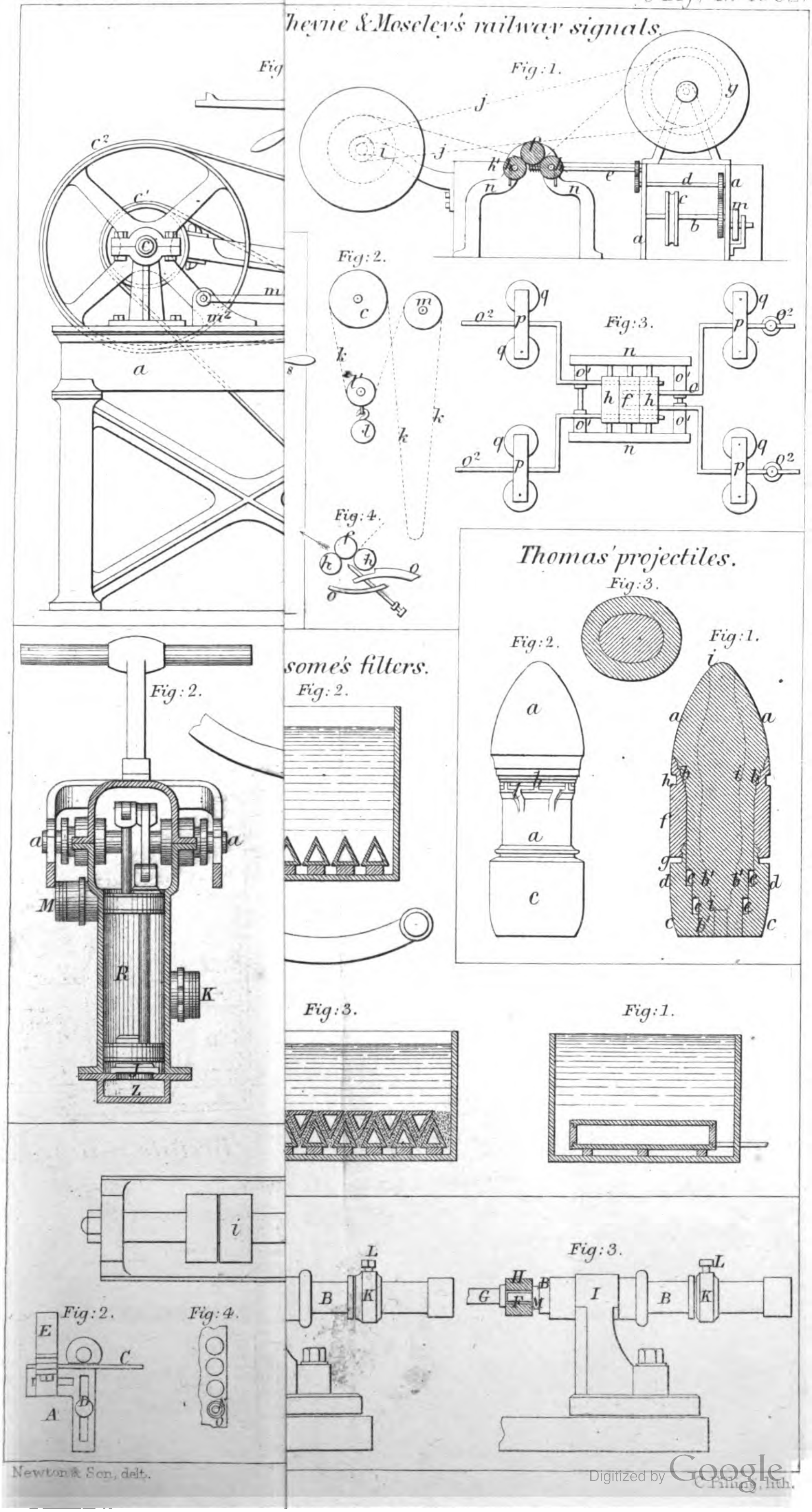
1210. R. C. Mansell.
1211. P. R. Drummond.
1214. John Elder.
1216. James Aspinall.
1220. William Hale.
1221. William Fisken.
1222. Lachlan McLachlan.
1226. T. U. Brocklehurst.
1234. H. W. Hart.
1237. Aaron Lester.
1243. Robert Vaile.
1246. H. F. Wells.
1250. S. W. Newington.
1251. Edwin Clark.
1252. William Clark.
1253. John Ross.
1256. W. L. Tizard.
1257. D. M. Childs.
1258. D. M. Childs.
1259. D. M. Childs.
1260. E. B. Wilson.
1264. Edward Moore.
1265. A. and B. Travis.
1269. George Davies.
1271. James Maiden.
1277. J. M. Carter.
1278. Alexander Prince.
1279. Werner Staufen.
1280. J. L. Norton.
1281. J. M. Napier.
1284. Henry Willis.
1286. W. T. Loy.
1287. J. Swallow and J. Allinson.
1289. C. P. A. Douchain.
1291. W. and T. Huntington.
1293. W. Bodden and W. Mercer.
1299. R. A. Brooman.
1300. C. F. Whitworth.
1301. Matthew Paul.
1307. Henri Juhel.
1309. E. Ormerod and C. Schiele.
1311. J. M. Herdevin and J. A. Jullien.
1312. Thomas Snowden.
1314. Elizabeth Herdman, A. F. Herdman, and J. Herdman.
1318. John Fowler.
1321. J. and T. Mellodew and C. W. Kesselmeyer.
1322. Charles Schlickeysen.
1323. John Heyworth.
1325. Alfred Williams.
1327. L. G. Perreaux.
1328. Herbert Allman.
1331. T. F. R. Brindley.
1335. Robert Burley.
1337. James Roscoe.
1339. E. B. Wilson.
1341. John Adcock.
1344. Richard Mills.
1345. Augustin Morel.
1347. Paul Chenailler.
1348. John Clarke.
1349. W. and J. Richard.
1351. William Greaves.
1353. William Clark.
1354. William Clark.
1355. J. E. Ransome, W. Copping, and L. Lansdell.
1358. Eugène Bourdon.
1359. C. V. F. De Berville.
1360. P. H. Colomb.
1362. T. H. Hopwood.
1365. J. Johnson and A. Chapman.
1367. R. A. Brooman.
1368. John Combe.
1369. G. T. Bousfield.
1372. D. Marchal and A. C. De Wiart.
1373. John McCann.
1376. William Riddle.
1378. William Southwood.
1381. Charles Lungley
1382. G. C. Grimes.
1385. Leo de la Peyrouse.
1387. G.F.Greiner and J.H.C.Sandilands.
1389. Leopold D'Aubreville.
1390. T. K. Mace.
1394. Thomas Fawcett, jun.
1398. F. J. Bolton.
1399. F. J. Bolton.
1400. G. C. Haseler.
1403. William Clark.
1404. Robert Moore.
1405. Robert Moore.
1406. J. T. Cooke.
1409. James House.
1412. J. B. Cristofini.
1414. H. W. Sambidge.
1415. Henry Walker.
1416. John Milnes.
1417. Gustav Fuhrman.
1421. H. S. Firman.
1424. Henry Cartwright.
1425. W. N. Hutchinson.
1426. C. J. Neale.
1427. Handel Ashworth.
1429. A. B. Freeland.
1431. Thomas Buckney.
1432. S. B. Ardrey and S. Beckett.
1435. P. M. Lopez.
1438. Arthur Wormull.
1440. J. H. Johnson.
1443. William Clarke.
1447. William Southwood.
1448. R. M. Latham.
1453. R. A. Brooman.
1455. Henry Deacon.
1456. Andrew Smith.
1457. E. Whittaker and J. Clare.
1459. John Smith, sen.
1461. Adolphe Nicole.

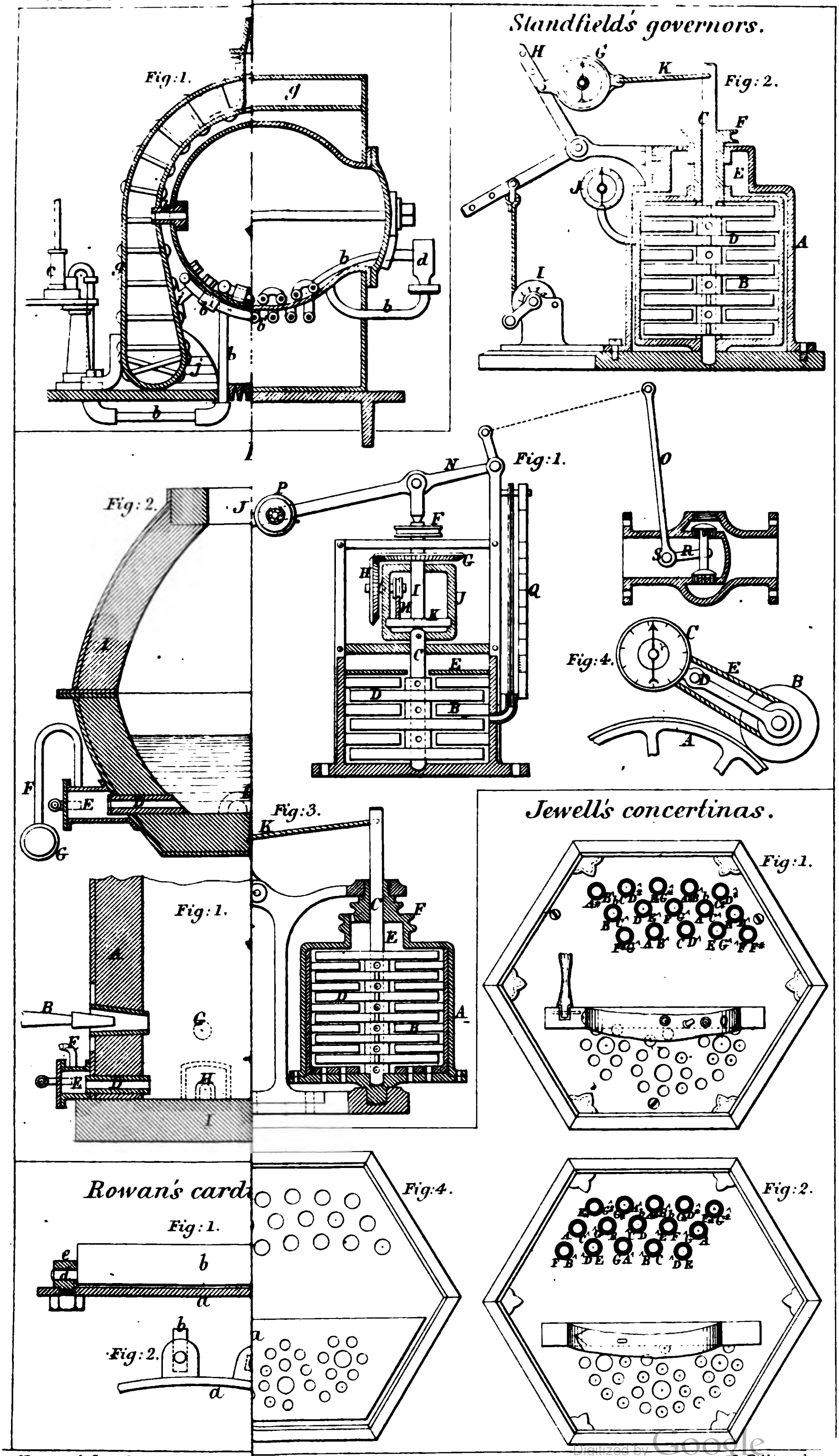
1466. J. P. Jouvin.
1467. John Dicker.
1468. William Sissons.
1469. G. H. Birkbeck.
1470. Josiah Stone.
1472. James Wright.
1474. Cooper Tress.
1475. J. Baggs and W. Simpson.
1477. Alfred Watney.
1480. George Haseltine.
1482. Richard Laming.
1484. A. A. L'Amiable.
1485. A. L. Thirion.
1486. F. B. Anderson.
1488. George Davies.
1492. Frederick Stocken.
1493. B. Sharpe.
1494. A. V. Newton.
1495. A. V. Newton.
1498. R. Davison and T. Johnson.
1500. James Hogg, jun.
1501. James Broadley.
1507. J. C. Gore.
1508. James Wright.
1509. James Eastwood.
1515. T. Morris, R. Weare, and E. H. C. Monckton.
1516. T. Morris, R. Weare, and E. H. C. Monckton.
1517. A. V. Newton.
1518. M. A. F. Mennons.
1519. M. A. F. Mennons.
1521. William Naylor.
1523. James Taylor.
1525. Edward Fewtrell.
1527. John Kennedy.
1528. William Petrie.
1533. M. A. Le Brun Virloy
1534. William Bush.
1535. Alfred Giles.
1539. John Oxley.
1540. C. W. Siemens.
1541. J. H. Perry.
1542. Eugène de la Bastida.
1543. George Crawford.
1544. Joseph Needham.
1545. S. and F. Turnbull.
1547. A. B. Childs.
1550. Henry Cook.
1551. W. Roberts and T. Greenacre.
1554. Peter McGregor.
1557. W. E. Wiley.
1558. James Webster.
1559. J. Ward and J. Dewick.
1560. Eugène Moulin.
1562. Alexander Samuelson.
1565. J. Harrison and R. Parkinson.
1566. W. and J. Harrison, J. Oddie, and William Parkinson.
1569. M. Walls and J. Crompton.
1570. Jacob Taylor.
1573. William Worby.
1574. J. A. C. N. Delpech.
1576. G. A. Huddart.
1585. Jonathan Ireland.
1588. Frederick Tolhausen.
1591. John Duffus.
1594. G. H. Daw.
1595. C. H. Hudson.
1598. James Simpson.
1607. J. H. Johnson.
1608. W. Blackmore and H. Lamb.
1609. J. A. Ransome.
1614. George Ashton.
1616. William Perks, jun.
1620 William Clark.
1624. F. Datichy and E. Sabatier.
1631. H. P. Burt.
1636. Julius Ives.
1643. Robert Shortrede.
1645. H. Watson and J. Millbourn.
1655. J. King and J. Partington.
1665. Edward Lloyd.
1670. Goldsworthy Gurney.
1678. George Peel, jun., and J. Simpson.
1691. Edward Conroy.
1699. P. M. Parsons.
1701. Edward Conroy.
1702. George Hadfield.
1708. A. V. Newton.
1760. C. A. Tyler.
1763. W. E. Newton.
1764. W. E. Newton.
1801. W. E. Newton.
1810. Montague Wigzell.
1827. Bernardo Fabricotti.
1883. Charles Cochrane.
1894. M. A. F. Mennons.
1911. W. E. Newton.
1934. James Webster.
1940. W. M. Williams.
1955. Joshua Kidd.
1971. J. M. Gille.
2006. M. A. F. Mennons.
2077. Thomas Meriton.
2093. C. J. Keene.
2105. Toussaint Lemaistre.
2145. Zirah Colburn.
2172. J. and E. Ransom.
2176. W. E. Newton.
2328. Charles Callebaut.
2343. Charles Monson.
2345. E. S. Ritchie.
2380. W. E. Newton.
2426. William Hunt.
2445. B. F. Cowan.
2488. Frederick Hands.
2602. William Clark.

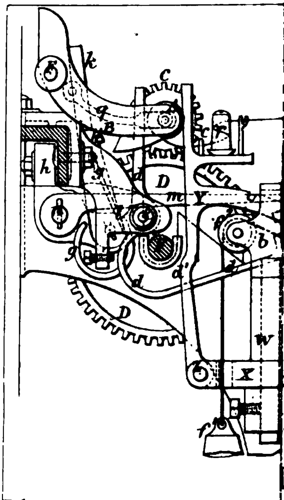
**** For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.*



Newton & Son. delt. C. Pilling, lith.


heyne & Moseley's railway signals.
Fig: 1.
Fig: 2.
Fig: 3.
Fig: 4.
Thomas' projectiles.
Fig: 3.
Fig: 2.
Fig: 1.
some's filters.
Fig: 2.
Fig: 3.
Fig: 1.
Fig: 2.
Fig: 3.
Fig: 2.
Fig: 4.
Newton & Son, delt.
C. Finney, lith.


Standfield's governors.
Fig: 1.
Fig: 2.
Fig: 3.
Fig: 4.
Jewell's concertinas.
Fig: 1.
Fig: 2.
Fig: 4.
Rowan's cardi
Fig: 1.
Fig: 2.



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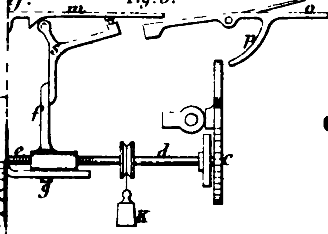


Fig: 4.

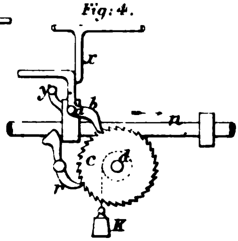
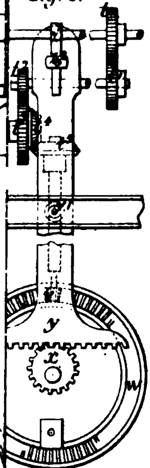


Fig: 2.



Cochrane's gas-meter.

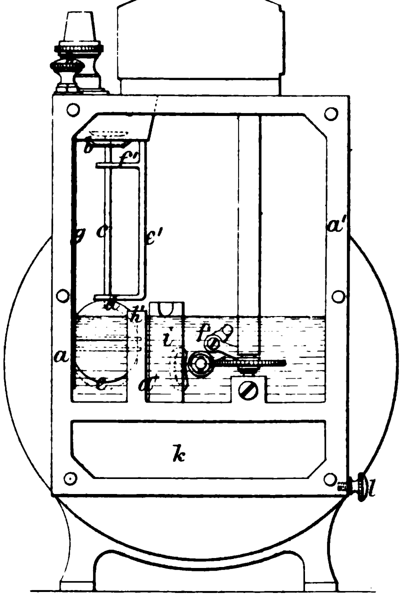
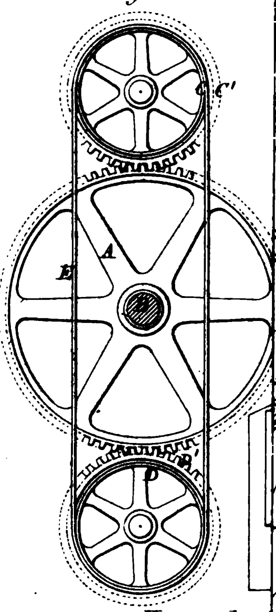
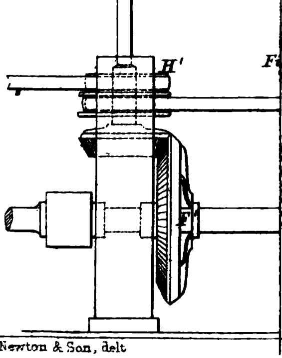


Fig: 1.

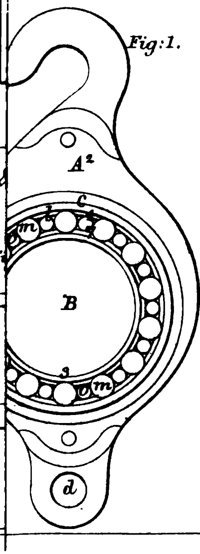


Kennedy &



Duchemin's blocks.

Fig: 1.



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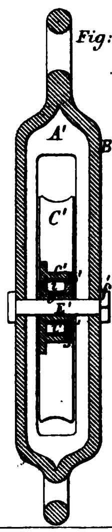
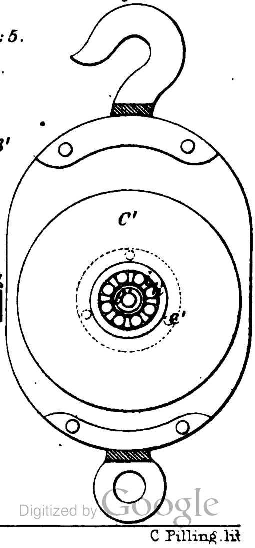


Fig: 4.



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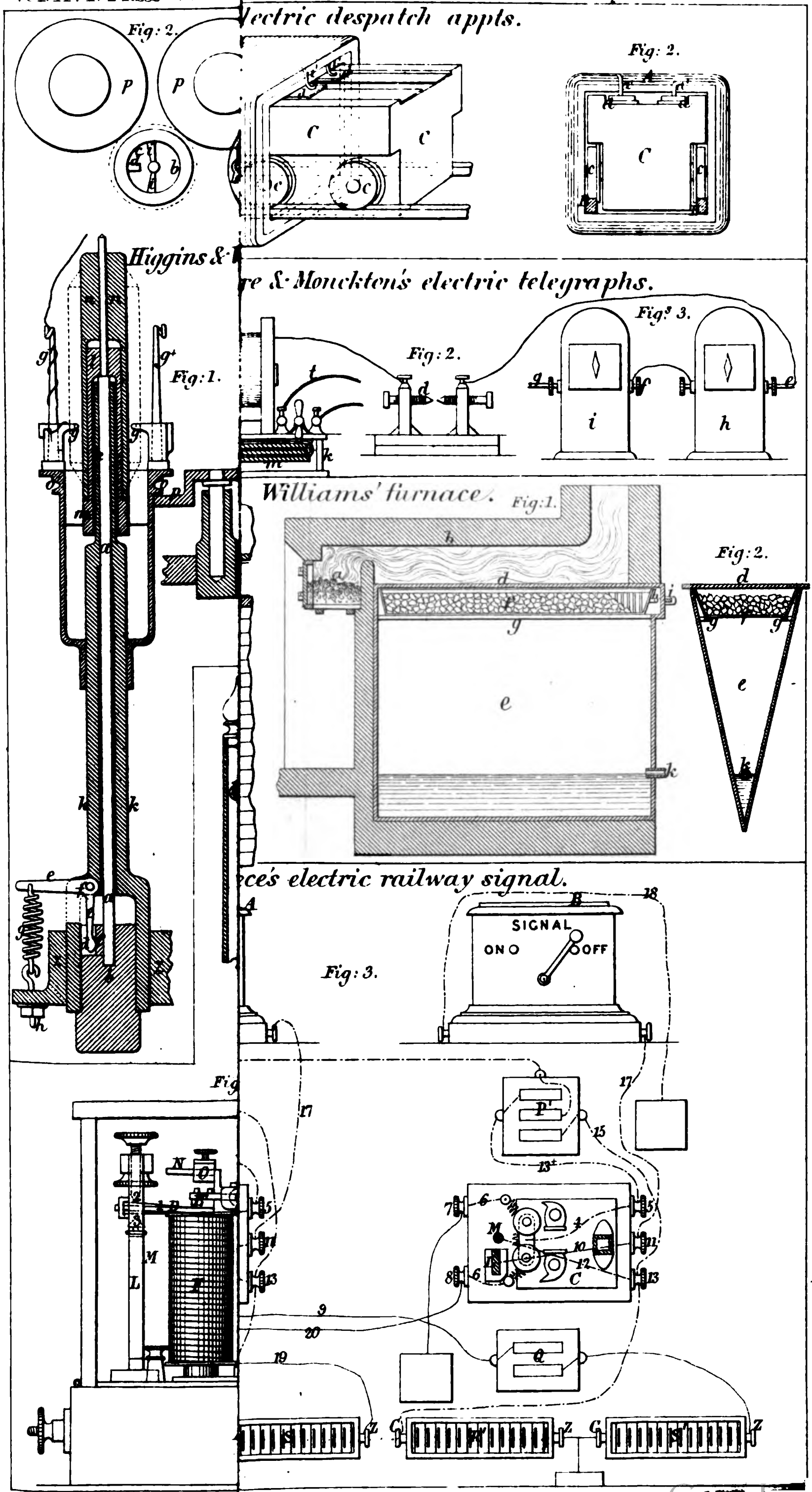
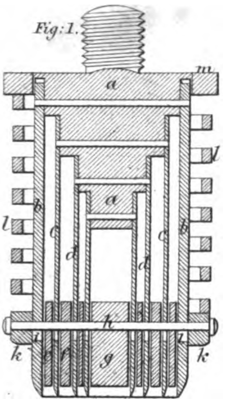


Newton & Son, delt.

C. Pilling

Scott's punching washers.

Fig: 1.



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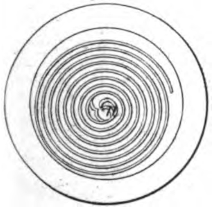
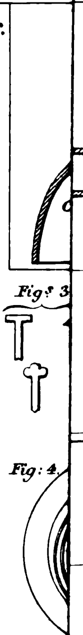
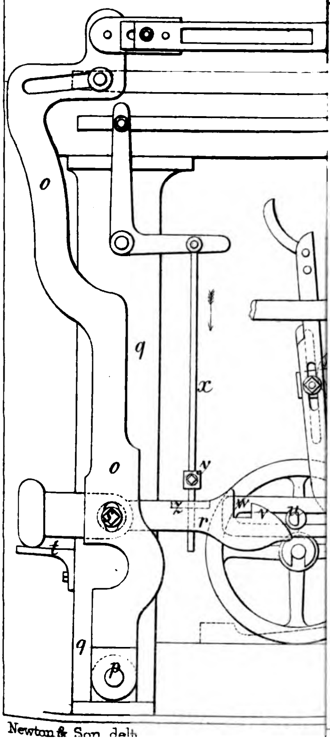


Figs 3

Fig: 4.





Westwood's hydraulic press.

Fig: 1.

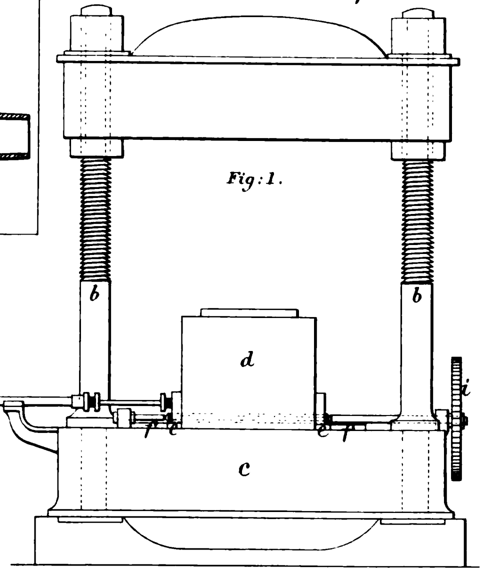
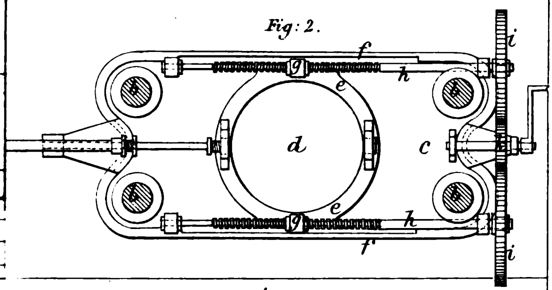
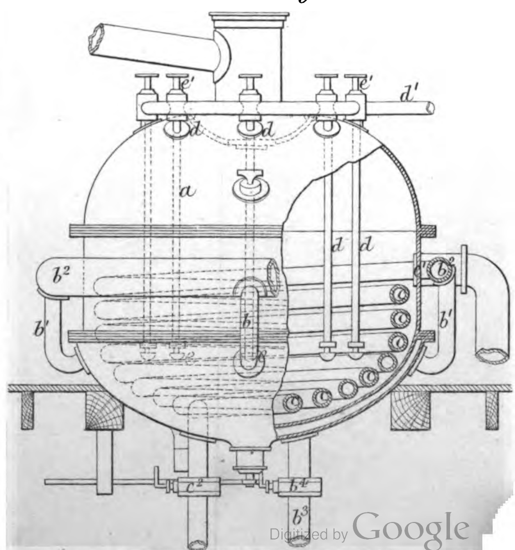


Fig: 2.



Patrick's sugar.



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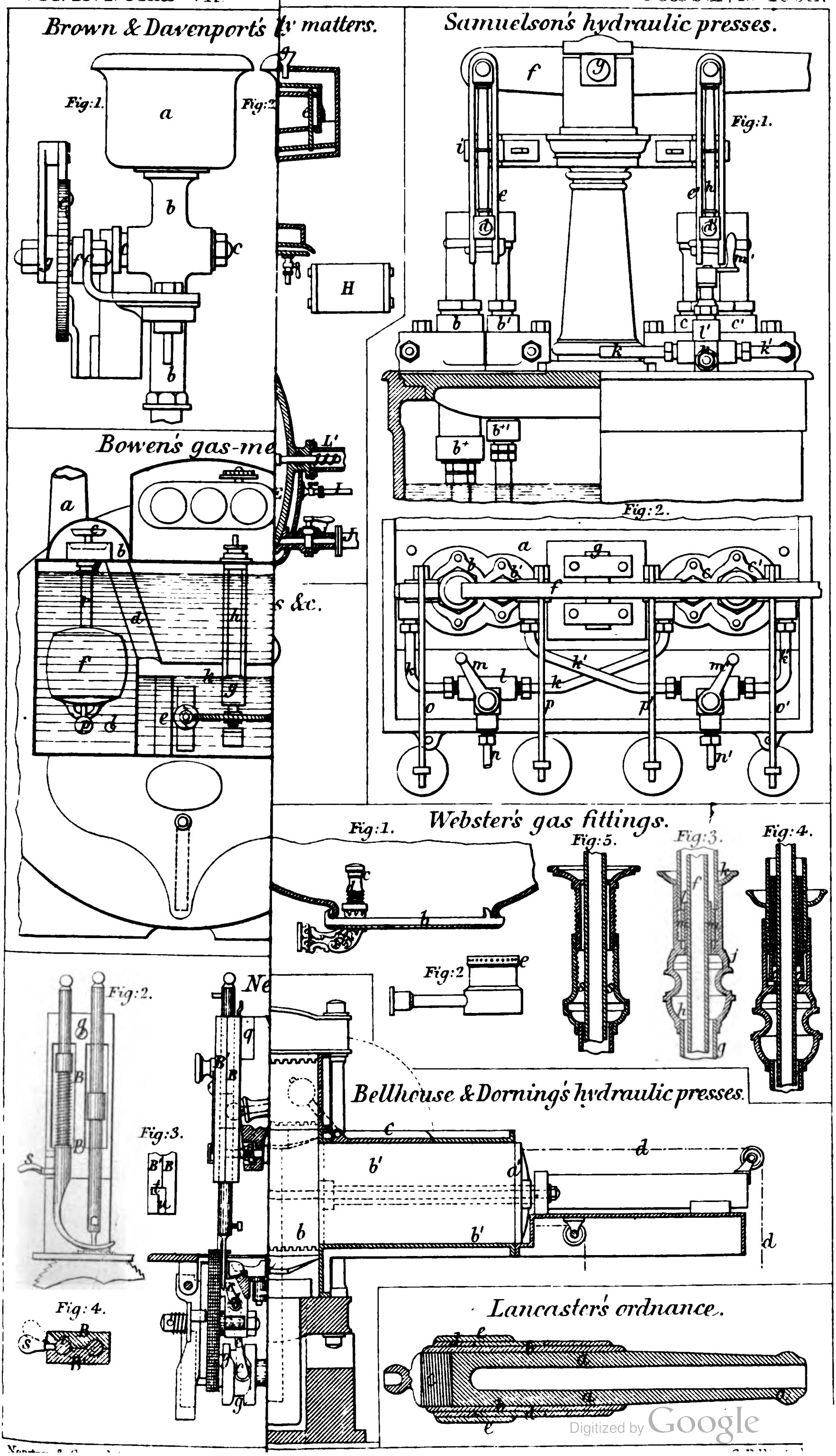
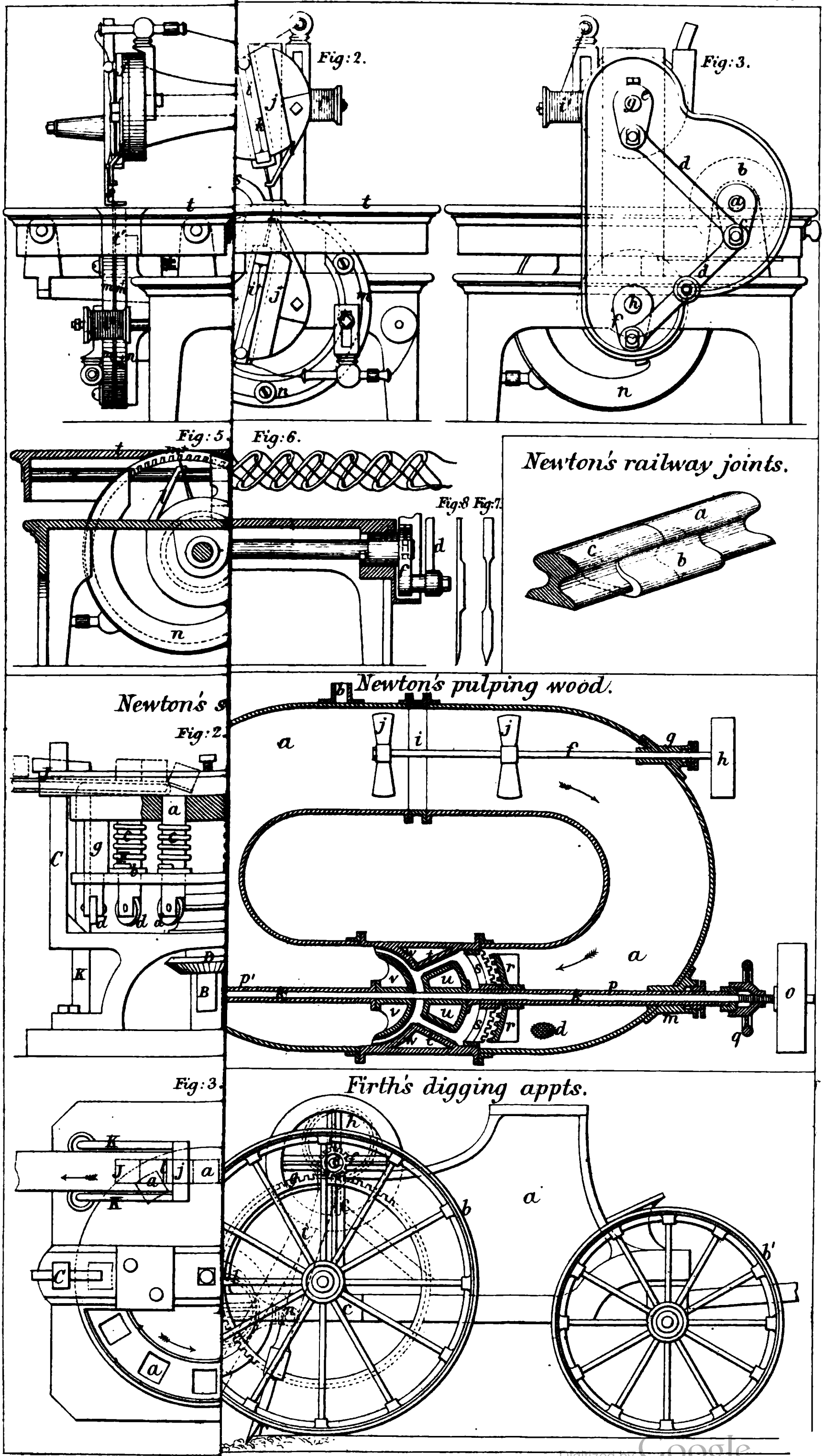

Brown & Davenport's
ty matters.
Samuelson's hydraulic presses.
Bowen's gas-me
s &c.
Webster's gas fittings.
Ne
Bellhouse & Dorning's hydraulic presses.
Lancaster's ordnance.



Newton & Son, delt.

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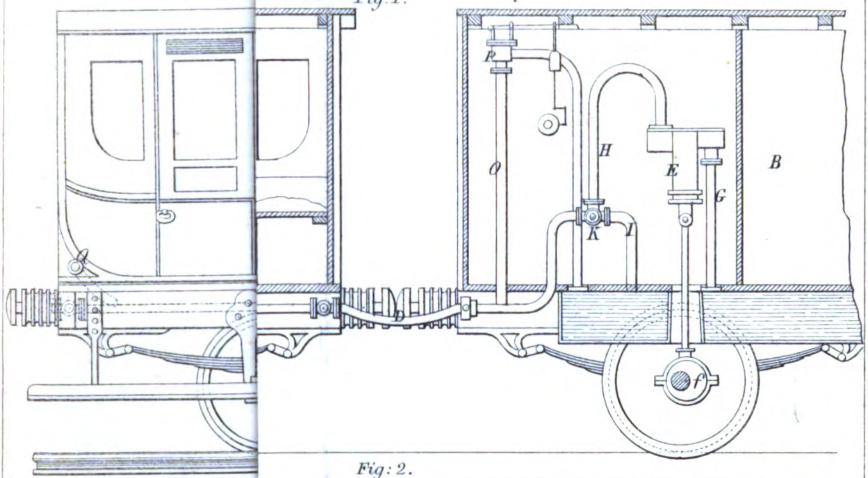
Fig: 1.



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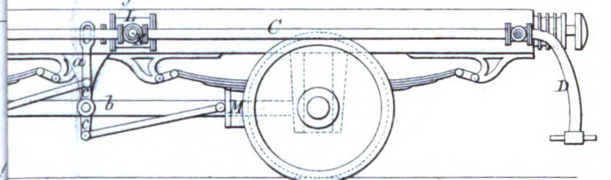
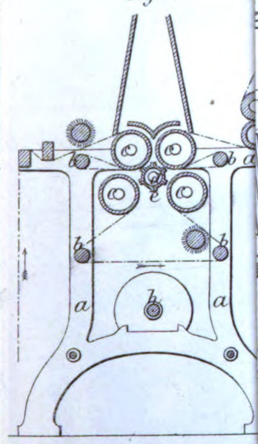
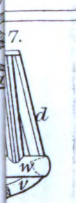


Fig: 1.



7.



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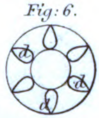
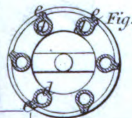


Fig: 8.



Bolton's rifle stoppers.

Fig: 1.

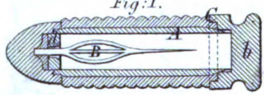
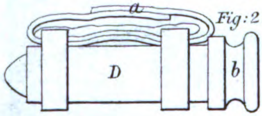
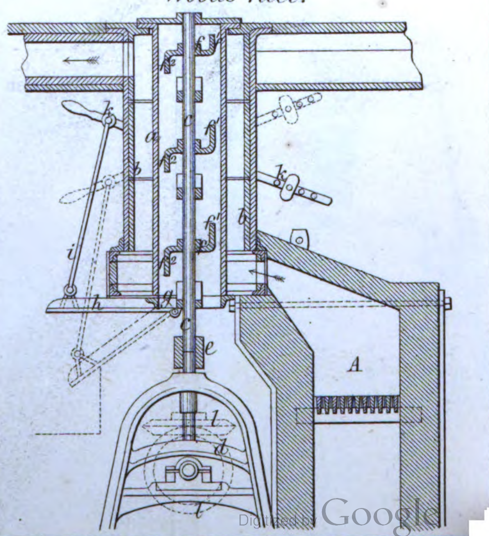


Fig: 2.

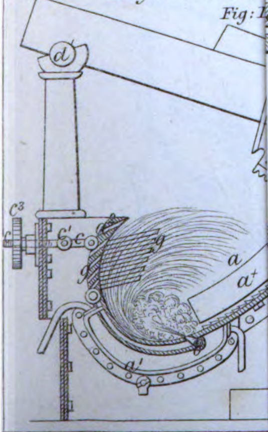


Wood's fuel.



Payne's beati

Fig: 1.



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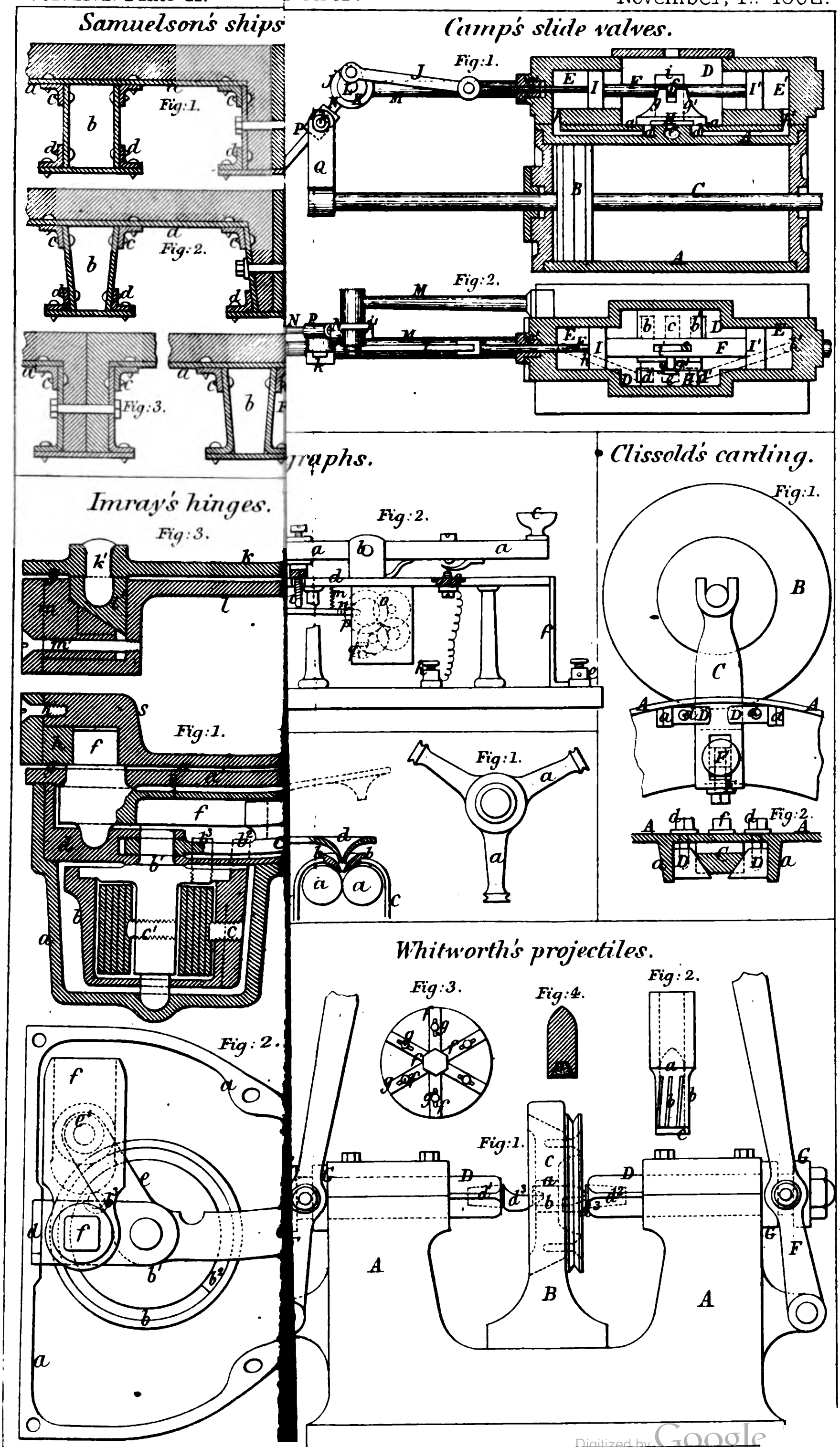
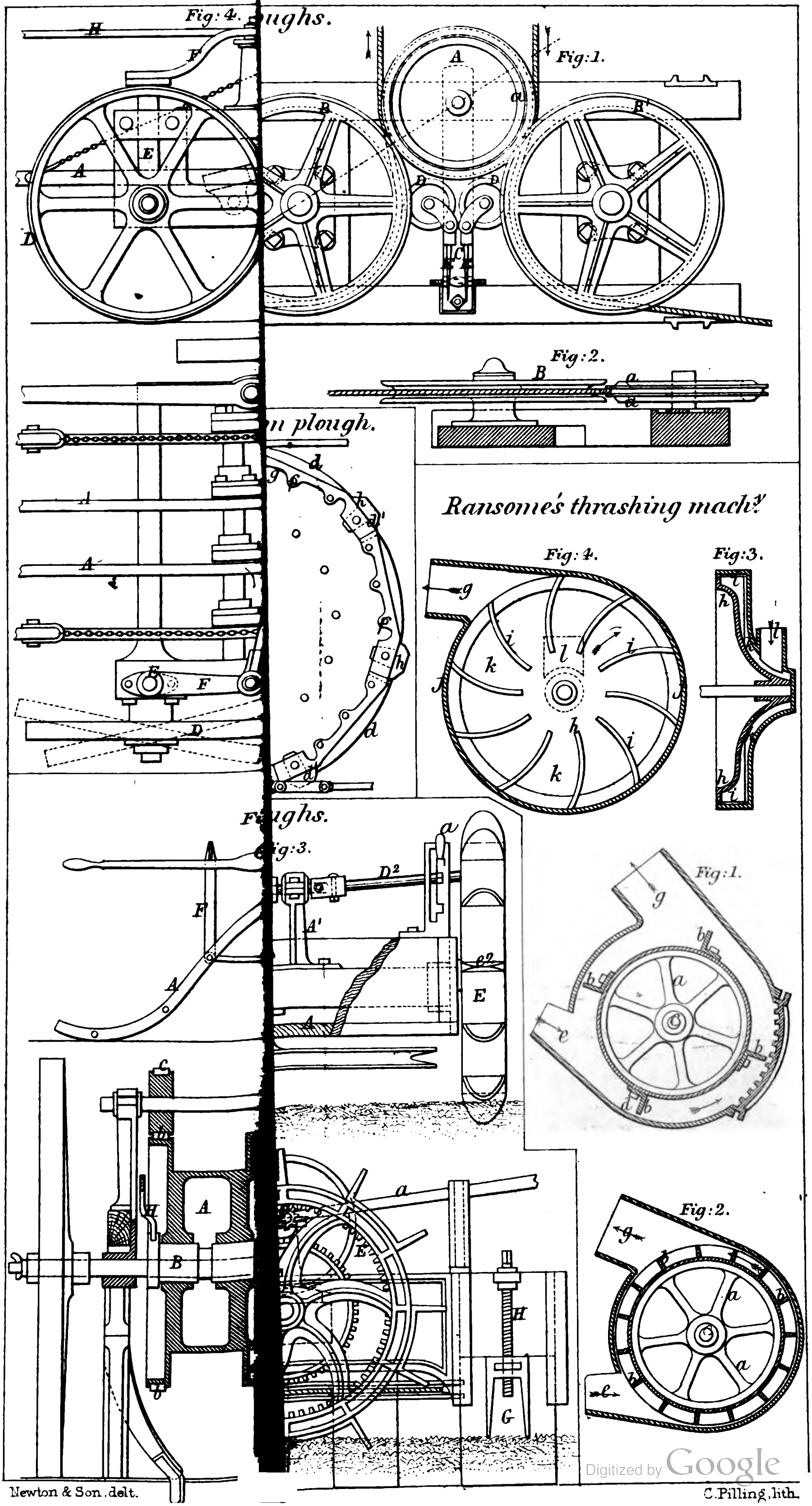


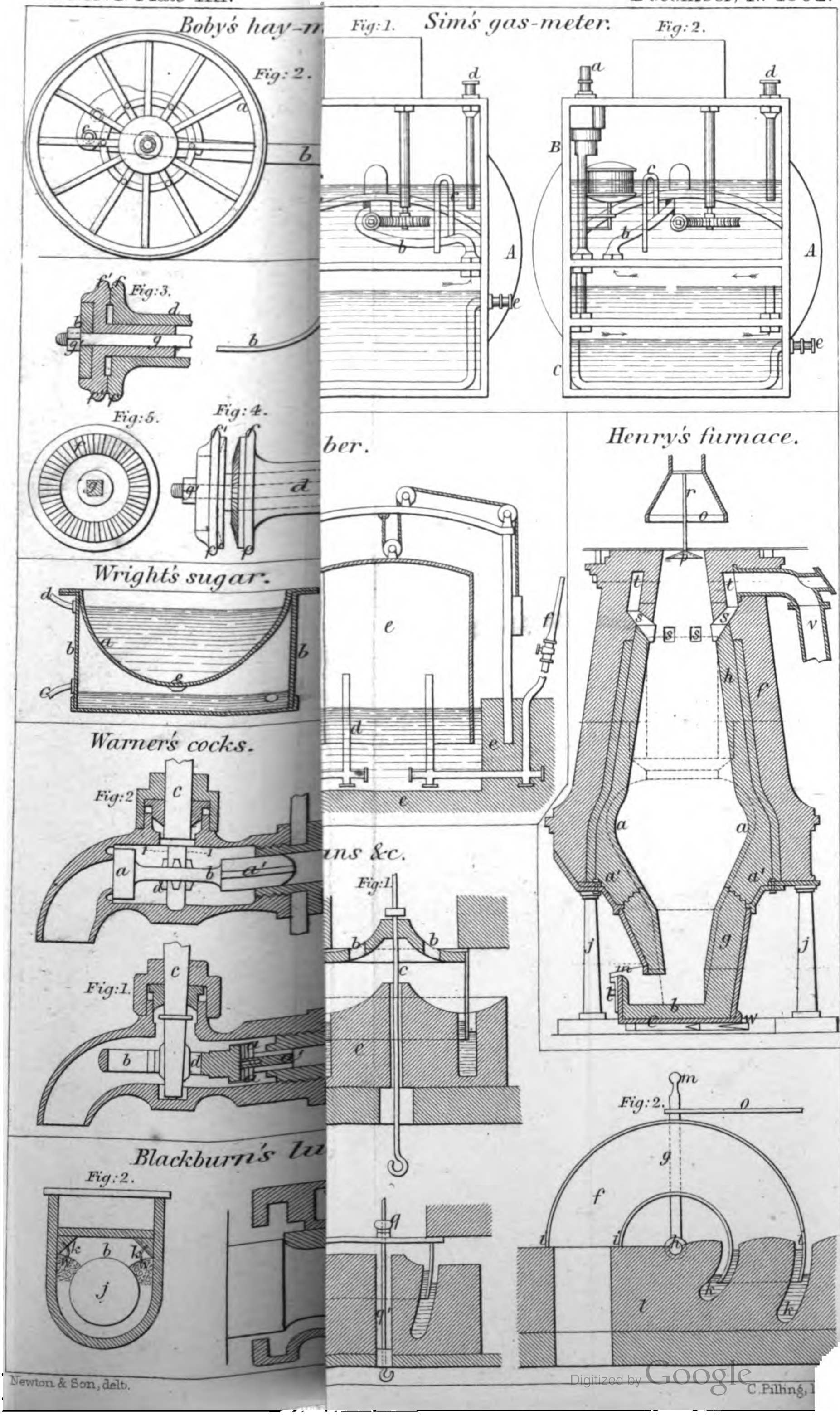
Newton & Son. delt

C.P.



Newton & Son. delt.

C. Pilling, lith.



Newton & Son, delt.

C. Pilling, l